THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE COAL TRADE.

THE past few days have been momentous in the history of the coal trade, as the Miners' Federation of Great Britain has been sitting to decide whether there shall be a national strike of the miners of Great Britain, but at the moment of writing we have no idea what the decision will be. We can only hope that in the interests of the country the leaders will calmly and carefully reason amongst themselves, and consider the terrible hardships such a course as they propose to pursue would bring to thousands of poor workmen and their families—many, we may point out, at the best of times considerably worse off than the miners—without bringing to themselves any lasting benefit, if, indeed, it would result in any good to them at all.

There can be no doubt that the miners throughout the country are filled with a spirit of discontent, though the different districts have their own particular grievances. In South Wales it is the "abnormal place" question, in Scotland it is a "minimum wage," and in Northumberland and Durham it is the "three-shift" system. The miners in the county of Northumberland have already voted on their particular grievance, and having obtained the requisite majority of two-thirds of the membership to strike, are really only waiting for the approval of the National Federation in ordering a national strike, before carrying the threat into execution. We sincerely trust, however, that the Northumberland miners and their leaders have given due consideration to the note of warning uttered by Lord Furness in his address to the shareholders of the Broomhill Collieries, Ltd. In this his lordship pointed out that the substitution of a two-shift—which the men require—for the three-shift system would entail a loss to the company of some £30,000 to £40,000 per annum, a loss which no company could possibly face, and that they had definitely decided, in the event of a successful county strike, to close their collieries. Further, he referred, and rightly, to the increased competition of the Westphalian coalfield in Germany, and to the increased competition of the coalfields of Yorkshire and Scotland for markets once looked upon as belonging solely to Northumberland, and he added that if the whole of the Northumberland pits were closed to-morrow, the gap would very soon be filled. He quite recognised that men should have fair pay for their work, but he also thought that 7s. 3d. to 7s. 6d. per day of seven hours' work with *free* house and coals was not bad pay for hewers. If *no man* were to receive less than 7s., and as much more as a good working place might give him, the county average in that event would probably reach 10s. per day of seven hours, and "prices in the home trade would rise accordingly, their export trade would be diminished, and they might in sober earnest have 'coals brought to Newcastle.'" Further, he said, "It was a comparatively simple thing to fix the hours of toil and the rate of pay, and

to say that all else must be adjusted thereby; but with this done they had not touched the real governing factors, and the man with labour to dispose of would have *at last to realise* that in the long run, and despite artificial manipulation, it must find *its own level in the markets of the world*," which is much the same thing as we ourselves said a week or two ago, when we pointed out that the miner would have to be taught that the selling price was fixed, not by the colliery-owner, but by the purchasers in the open markets.

The other two questions, which are really the most important, are those relating to "abnormal places" and a "minimum wage." Both these resolve themselves into a wage question, as the demand in regard to "abnormal places" is that a fixed minimum wage shall be fixed for any workman called upon to work in what is termed an "abnormal place," which means any working place in which the conditions, such as the hardness of the coal, lowness of the seam, wetness, or other difficulties, prevent the workman "hewing" as much coal as he could do in a "normal" working place in the same seam. On the 28th ult. the Coalowners' Association met the miners' representatives to discuss this question, but the parties could not come to any agreement. It will be at once seen that it is a proposal fraught with the most serious consequences to the industry, and naturally the coal-owners cannot look upon it in any other way than in a spirit of grave distrust. As mentioned by Lord Furness, if "*no man* is to receive *less* than, say, 7s.," naturally the best men will require much more to stimulate them to put forward their best efforts, and in consequence the average earnings cannot but be increased, or as a corollary to this the output per man would be reduced to the quantity which the officials of the mine could obtain by constant supervision. In fact, a state of things would occur similar to what happened in our engineering workshops, when it became necessary to create a new official in the shape of the much maligned and hated "feed and speed" man.

Unfortunately, there is amongst the ranks of the miners —probably to a greater extent than in any other industry— that type of Socialist, who, being a poor workman himself, is constantly sowing seeds of discontent amongst his mates, and what is worse is that, with an eye to a well-paid office in the union, he is encouraged to do so; hence the miners themselves provide the rod which flays them. It is this type of man who, by prating about the wealth of the country being in the hands of the few, and by arguing that such wealth being all earned by labour ought to be received and enjoyed by labour, is undoubtedly the sole cause of the present discontented state of the labouring world. But, however much this may be theoretically true, the miner must be taught that a national strike, far from making the wealthy poorer, and the poor richer, would have exactly the opposite effect.

In last week's issue the *Colliery Guardian* gave the results of an examination into the financial resources of the miners' unions and expressed the opinion that the funds would probably amount to £1,750,000, and that the membership would slightly exceed 700,000, thus giving a sum of about £2 10s. per head. Hence allowing for a payment of 10s. per head per week, and extra payment "where a number of months have to be fed," there would be no difficulty in carrying on a stoppage for a period of, say, three weeks.

What would be the effect of such a terrible calamity we do not care to contemplate. Probably no one would be able to forecast even a tithe of the amount of suffering by the poorer people and the dislocation of trade, and general hardship and loss to the country at large. One thing is certain, it would take months to repair—if it ever could be repaired—the damage done to the trade of the country in weeks, and the industry that would suffer most of all would be that of coal-mining.

The M.T.A.: An impression of the Glasgow Conference.

All good things come to an end; on Friday last the 10th annual Conference of the Municipal Tramways Association, which was held in Glasgow and attended by some 200 delegates, was concluded.

The three days' proceedings opened, as is usual in Glasgow, with a reception of delegates by the Lord Provost, and after the morning's business, a midday luncheon, and dinner in the evening—at the invitation of the Lord Provost and members of the Tramways Committee—served to remind the delegates of the hospitality for which civic Glasgow is justly famed.

On the following day the venue was changed to the Newlands Car Depôt, about two miles south of the centre of the city, where again, the morning was devoted to business and the afternoon to a visit to Rouken Glen—a favourite pleasure resort of Glaswegians—while the evening was fully occupied by the Association dinner. The third day was devoted wholeheartedly to an excursion to Ayr and the Land of Burns, including once more a luncheon and afternoon tea, this time by invitation of the Ayr Tramways Committee.

Next to the festive side the most lasting impression gathered was the informal formality of the proceedings. The suave president kept order—by the interjected question and the ready retort—in a way which, conceivably, in many meetings might have caused disorder, but there was, as usual, a pleasant spirit of genial *bonhomie* and *camaraderie* throughout the whole conference. The first day's papers were mainly on tramway finance and policy. Councillor Nelson, of Glasgow, explained the city's "Common Good Fund," and Councillor Rodgers, of Newcastle, gave his views on "Tramway Finance and Policy."

Councillor Rodgers did not require to look for trouble—it came upon him from all sides. He had been prying into figures and statistics, and was quite full of them — they exuded from every pore—and he had discovered that a score or thereabouts of tramway undertakings were not financially sound, and so he had promptly blacklisted them. In rousing periods he denounced the immorality of having no sinking fund, of not building up a strong reserve fund, and of not charging a profit-making fare—whether a "fair" fare or an "unfair" fare did not apparently matter very much so long as a profit was the result.

We then had Mr. Squires, L.C.C., asking how an all-night service of cars could be made profitable on 1d. fares. "Charge 6d., if need be," said the author, but make a profit. The excuses were as numerous as the blacklisters. The Tramways Committee were overruled by the Council, said Burnley; we paid £120,000 to the old company for some scrap-iron and a few horses, said Blackburn; the Government auditor will not allow us to set aside a renewal fund, said Plymouth; we *had* a bigger reserve fund, said Wallasey, but we took some of it to build cars and car-sheds. It was all very humorous, but indicated very plainly the great need which exists for some independent, impartial and thorough investigation into the whole question of tramway

finance. The position at present appears to be very chaotic. Councillor Rodgers is evidently "a firebrand of the first wa'ther," as the Irish M.P. had it.

The first paper—read only in abstract—on the second day was by the brothers Cunliffe, of Manchester, on "Tramcar Meters." The discussion on this paper resolved itself mainly into a "battle of meters," as Mr. Spencer, Bradford, phrased it, the only dissentient voice being that of Mr. Hamilton, Leeds, who appears to think that the saving in energy obtained by the use of meters is sometimes attended with neglect of, and inattention to, the needs of passengers. The general opinion, however, was that meters were useful in discovering not only faulty drivers but also faulty equipment, badly adjusted brakes, worn bearings, faulty field coils, &c.

The concluding paper gave a tripartite report on "Replies to Queries," *re* tramway track construction and maintenance by the representatives of Glasgow, Manchester and Leeds. Queries had been sent out to a large number of tramway undertakings, and the collaborated replies formed the basis of these papers, but so varied is practice and experience, that no fewer than three varying and partially contradictory reports were the outcome.

Mr. Mozley, of Burnley, gave his opinion on the use of the oxy-hydrogen and oxy-acetylene welding and cutting processes, and mentioned figures showing the saving in building up crossings, &c., in the works. Mr. Grierson, of Glasgow, in his report stated that Thermit joints do not stand the wear, but Mr. McElroy, of Manchester, was confident that Thermit holds the day. Mr. Knowles, of Sheffield, challenged the statement made by Mr. Holt, of Leeds, that the steel used for tramway rails was "rubbish," and stated his conversion to Thermit-ism owing to the scientific manner in which the welding is now done. The President (Mr. Dalrymple) closed the discussion by pointing out that on the ·65 carbon open hearth steel used in Glasgow tramrails, the Thermit Co. had called off, as they could not guarantee the welds.

One felt sorry not to have had some information as to the electric welding of rail joints, for a good many have been so welded in Glasgow and other places throughout the country. The need for research into the best composition of rail steel was emphasised throughout the discussion, and the form of section recommended by the Engineering Standards Committee found very little favour. The whole question of track maintenance and construction was once more remitted to the Executive Committee, and the three experts who contributed the report, with the feeling in favour of standardisation very strongly emphasised.

As a result of the annual business meeting, Mr. H. E. Blain was elected president for the ensuing year, and the Association is to hold its next Conference at West Ham.

An innovation this year was an exhibition of tramway equipment and apparatus in the Newlands Depôt, a large number of firms being represented.

Electricity in Western Australian Mining.—A series of articles on "The Mining Industry of Western Australia" has recently been appearing in the *Times*. The author, Mr. G. W. Williams, arrives at the conclusion that a central power house is wanted. He expresses this conclusion in the following terms:—"Broadly speaking, the metallurgy of the field is of a high order, and, all things considered, compares more than favourably with any other field in the world. But metallurgical work in connection with complex ores must ever remain an expensive item, and material reductions in cost are not probable in existing circumstances. It is to be regretted that it is not possible to provide some central power house, owned by the mines and provided with the most efficient type of generators. Such a scheme, by supplying cheap electric power, would materially decrease power costs. On the Rand the problem of reduced grade was met by amalgamating adjoining low grade properties and by the erection of plants of large capacity. If such a scheme could be applied to several mines on this field, it would materially increase the productivity. There are difficulties in the way, but this is certain: a mine treating 10,000 tons per month in its own mill must reach the limit of profitable work sooner than it would were it worked as part of a larger mine and the joint product treated in a mill which had a capacity of, say, 30,000 tons per month. The cost of transport from the mines to the mill would be far smaller than the increased profit due to centralised work. Centralisation, intelligently carried out, must mean decreased cost, and that means increased profit and life. If this is not carried out in the near future there are many mines which will reach the point where no scheme of amalgamation could possibly save them from extinction."

THE ANGLO-BELGIAN LOADED TELEPHONE CABLE.

We were able recently to announce the laying by Messrs. Siemens of a new loaded telephone cable between England and Belgium.

It is interesting to note that about one week after the cable had been laid, a fault occurred, which was localised at a point about 2½ miles from St. Margaret's. The ss. *Alert* repaired the cable in about 12 hours, and the fault was found to be due to a bad joint between one of the cores and the insulation of the coils. The short time required to remove this fault, which naturally included the inserting of a new set of coils, shows that there is no difficulty in repairing this class of cable.

The cable differs from the one laid between Abbott's Cliff and Cape Grisnez (which cable, we understand, is still in perfect condition), in so far as special loaded coils have been introduced, which enable a superimposed or "phantom" circuit to be worked, in addition to the two ordinary loop circuits, an advance the importance of which is obvious.

We have been favoured with some interesting details of the "constants" of the cable, as follows:—

1.	Resistance per nautical mile of loop conductor without coils.	14·2 ohms at 15° C.
2.	Capacity per nautical mile of loop conductor without coils.	0·157 mfd.
3.	Capacity per nautical mile of phantom circuit without coils.	0·314 mfd.
4.	S/K at 800 cycles per sec. and 15° C., and is not proportional to frequency.	12
5.	Self-inductance of the coils for the transformer circuit.	0·1 henry.
6.	Ohmic resistance of the inductive and non-inductive coils in the transformer circuit.	6·6 ohms.
7.	Effective resistance of the inductive and non-inductive coils of the transformer circuit at 800 cycles with 1 milliampere at 15° C.	11·5 ohms.
8.	Self-inductance of the coils in the phantom circuit.	0·05 henry.
9.	Ohmic resistance of all coils in the phantom circuit.	3·3 ohms.
10.	Effective resistance of all the coils in the phantom circuit at 800 cycles with 1 milliampere at 15° C.	4·6 ohms.
11.	Capacity of the coils in the transformer circuit.	·004 mfd.
12.	Additional capacity of the coils in the phantom circuit, less than	·0001 mfd.

"βl" for 50 nautical miles, measured with the Franke machine:—

	$2\pi n$ = 3,000	4,000	5,000	6,000	7,000
Transformer circuit	0·863	0·872	0·893	0·920	0·977
Phantom circuit ...	—	0·877	0·904	0·928	—

An interesting fact, we note, is that the βl values for various frequencies differ but little from each other.

Manufacture of Ice at Electricity Works.—In many places iceworks have been established in connection with electricity works; there are 212 such combined works of 50 to 500 kw. in America. The results show that a fair income may be derived from the industry. One factory, for instance, produces 25 tons a day and supplies cold, so to speak, to four great cold stores; 65 kw.-hours are consumed per ton of ice. The ice is sold for 12s. 6d. per ton, and the net profit amounts to 0·75d. per kw.-hour. A factory employing the compression method only consumes 50-60 kw.-hours per ton. Another electricity works is able to produce 10 tons of ice per day, and during June-September, 1910, delivered about 9,880 tons of ice, which was sold at prices varying between 2s. 9d. and 4s. 7d. per 100 kg. The income amounted to 26s. 5d. per ton; the expenses in connection with manufacturing, &c., were 12s. 4d. per ton. When administration and other expenses were deducted, there remained a net profit of £480, representing 13 per cent. on the capital. The sale price at this factory was, for a consumption of less than two tons a month, 4s. 7d. per 100 kg.; for two tons, 3s. 8d.; for 8 tons, 3s. 3d.; and for more than 8 tons, 2s. 9d. We do not often have a long hot summer, but there is always a demand for ice in the "off" season for electric lighting, and the business is admirably adapted for working in conjunction with electricity supply.

D

THE EXHIBITION AND THE PUBLIC.

By the Engineering Correspondent of the *Daily Telegraph*.

If there is one branch of science which appeals to the general public it is that which deals with electricity. The "Man in the Street"—not the man in the gutter, but the intelligent citizen—is brought face to face with the applications of electricity to his convenience a dozen times a day. More particularly is this true of the Londoner. For in the capital of the Empire there are gathered together the leading lights of the profession—they are interviewed, they speak in public, and nearly all of the scientific societies of any importance hold their meetings in London. The Londoner is a more omnivorous reader than his country cousin. If it were possible to obtain exact data of the places where the newspapers reach, it would undoubtedly be found that the average Londoner spends more on that modern necessity than does the provincial man. This may be partly due to his less sociable instincts, and the longer time spent in travelling. But the fact remains. Then there are the electric trains, the brilliant scenic effects at the theatres brought about by electricity, the latest novelties in the great stores (such as Harrods', Whiteley's and the others), as well as the huge hotels.

For London contains wealth. It also contains—it draws as a magnet from the provinces and even from abroad—the picked brains of every profession. And when you have wealth and intellect you will certainly find progress. London also has its exhibitions. One of the best that has ever been held is that which is now on view at Olympia. The exhibits show quite clearly that the average standholder has caught hold of the fundamental notion of such an exhibition. He must first of all *interest* the prospective customer; then he will educate him. Then he will sell the goods.

The Electrical Era.

If anything is wrong with the public, it is that they expect too much, and are a little afraid of electricity. Anything bordering on the supernatural is put down to that agent. Not very long ago the writer was in the engine room of a warship. Behind the main condenser two stokers were arguing, so vehemently that our entrance was unnoticed. This was the conversation, translated and with superfluous adjectives of an emphatic nature omitted.

"What made the woman wash the baby in the picture?" asked Jack of his pal, who had been with him to the cinematograph show. "Electricity," replied his friend. "Oh—I forgot that," was the reply. No other suggestion was necessary. Of course, every reader of this paper knows that the fire which cannot be accounted for is put down to a fused wire. And the frequent message from the hoardings to the credulous is "Electricity is life." Even Miss Marie Corelli, with a circulation far beyond that of the technical journals, talks glibly about electricity and the soul. She, with the ease of the uninitiated, connects the two together for the benefit of her non-scientific readers.

Another great fault of the public is that they think electricity is so expensive. The "plumber and electricle engineer" (as one gentleman put on his sign) trades on that idea. It must be obliterated from the mind of the public, for there is a great market for the manufacturers when they can get rid of these superstitions.

It must be frankly confessed that very many foolish and impossible things about electricity have in the past appeared in newspapers. To some extent it is almost impossible to prevent occasional mistakes in the most highly efficient organisation, working under intense pressure. And a newspaper office is always working overload. Just as the paper is "being put to bed" there comes a curt cable that a warship is blown up or a foreign monarch has expired. It is news—it must appear, or the reader will comment on the lack of enterprise of his favourite journal. And there is such a demand for space. However, most of the great journals nowadays either leave applied science severely alone or place the matter in expert hands. During the last few years there have been fewer errors in the responsible Press concerning matters electrical. It is in the interest of electrical engineering that such an improvement should exist.

An Educational Effort.

As a frequent reader and contributor to the technical Press, the writer fully appreciates the absolute necessity for these journals and the competent manner in which most of them are conducted. They have a mission, which they admirably fulfil, of an educational nature. They deserve, most emphatically, the full support of engineers. They are the life blood which stimulates our thoughts. But they are not read by the public. And those who have at heart the welfare of the engineering industries of the country—upon which its greatness is based—desire three things: (1) that the public shall demand the latest applications of science to their households and their daily work; (2) that the politicians shall understand that every assistance, and no restrictions, shall be made by law in the development of applied science industries; (3) that the general public shall understand that the engineer is entitled to as high a status as the lawyer, the doctor or other professional man.

For those reasons the writer has gladly done all in his power to induce the public to visit Olympia, for he regards the exhibition as a great education for the twentieth century householder. But for the expense to the shareholders, it would be a most admirable arrangement to have an annual show. However, that is obviously a matter of which the promoters of the Exhibition know best. They have every reason to be proud of the manner in which the visitors to Olympia express themselves. They are delighted, entertained and instructed. While it is quite true that the Manchester Exhibition was a success, this one will certainly eclipse it from all points of view, for there is no place in the world like London if you have something that will interest the public. In the metropolis and its suburbs there are somewhere about 7,000,000 people. While there is abject poverty in that area, there is also wealth, undreamt of a century ago. And, after all, the public wanted at the Exhibition are those in a station of life which permits them to *buy* something electrical. Moreover, there have been many visitors from the managerial departments of the large hotels, stores and other places where the demand for electrical goods is created by the public.

THE NEW SERVANT.

By "MAUD."

(*Concluded from page* 535.)

There has been continued progress during the past few years with regard to appliances used for electric heating and cooking. It was not to be expected that men whose sphere is not cooking would arrive at perfect cooking apparatus at once, and neither was it possible, I suppose, for scientists to produce materials that would withstand for long periods repeated heating. At the present time, however, electric heating apparatus, including that for cooking, is very reliable indeed.

There are two chief purposes for which electricity can be used other than for lighting; these are heating of rooms and cooking. As they are really both entirely different parts of one of the most expensive matters in connection with the upkeep of the household and its cleaning, anything which effects a saving will be of special interest.

Taking the question of heating, the chief rooms in the average house to be heated are dining room, drawing room, kitchen, and occasionally hall and bedrooms. Dealing with the dining room, I find from experience that it is healthy and comfortable to keep this room at a temperature of 60° F. To do this, I should recommend the use of a six-light radiator with three switches and provided with the new Bastian heaters in place of the usual lamps, as they give out heat better. Such a radiator as this will keep the room hotter than the temperature I have given when full on in the middle of winter, and will cost 3s. 1d. per week to run with elec-

tricity at 1d. per unit. The figure given represents the average cost per week taken over the whole year, the size of the room being 15 ft. square × 12 ft. high. Following the dining room comes the drawing room; the cost of heating this is a very variable amount, due to the use to which this room is put. The heater should be the same size as for the dining room, but more elaborate according to taste and pocket. The average cost of heating this room per week is 1s. 9d.

Following the dining room comes the kitchen,. Here for a number of reasons a large quantity of electricity can be wasted, and it required careful thought to so install apparatus as to prevent waste. It is usual to have the electric oven and other appliances either in the kitchen or the adjoining scullery, and I find that the heat from these is sufficient to amply warm the kitchen until the afternoon, when a small two-light radiator can be switched on to keep up the heat when needed. Working on this system the average cost for the week is 1s. 1d. The question of the heating of the bedroom and hall is quite simple, and can be carried out by having switches and plugs fixed in these places to which radiators already in the house can be attached.

The total cost, therefore, of heating a house whose rental is between £30 and £45 per annum is 5s. 11d. per week, and allowing 7d. for the heating of the halls and bedrooms makes the average cost per week throughout the year 6s. 6d., a really reasonable figure, which favourably compares with the cost of coal in large towns without the attendant dirt, damage and consequent round of cleaning.

Turning to the question of cooking, this is undoubtedly the most interesting part of the whole of the numerous applications to which electricity can be put in the home. The most useful apparatus to have in a house of the size I have already mentioned is an electric oven large enough to cook a joint of meat, and at the same time to bake a pie or pudding. This oven should have at least four separate heaters, each controlled by a separate switch, so as to permit of the heat being under perfect control, and consuming when all are on about 2 units per hour. Such an oven will seldom require to be full on, but the heat is always there if wanted to do filleted plaice or other such processes which require great heat. The oven looks nice mounted on a white glazed brick pillar on the kitchen floor. In addition to the oven it is desirable that you have a quart size electric kettle, a large and small electric saucepan, and a small hot-plate to take a frying-pan or a small baking tin. This composes a perfect heating apparatus which is extremely economical to use, and which will do all the cooking required. The cost of running this cooking apparatus will average approximately 3s. 6d. per week for the usual number of meals, a truly reasonable figure when making a comparison with either gas or coal. The apparatus is perfectly clean, quite safe, and there is no risk of fire from its use.

The cooking done by an electric oven is as nearly perfect as it is possible to get, owing to the scientific arrangement of the heaters. There are no nasty fumes in the oven such as obtain with gas, which can be tasted in the cooked articles. The cooking is so perfect that there is no need for the paper bag craze, which seems to have originated to overcome the effect of the gas fumes; the doing away with this saves at least 3d. per week.

It will be seen by the reader who has carefully followed my remarks as to the different applications of electricity in the home, that the whole of the apparatus installed is such as to effect considerable savings in the amount of cleaning rendered necessary when gas is used for lighting, and coal fires for cooking and heating. This means that having done away with these dirt producers the cleaning will be less, and consequently your maids will have less to do—a state of affairs which will considerably inspire the whole atmosphere of the home, as half the trouble with maids is due to the large amount of work to be done, which continues over a long period each day. Lessen the amount of the work (thereby saving yourself trouble and continual worrying), and your maids not being overworked will have a better chance to do their work better and in a much better temper. In some cases the amount of labour rendered necessary for cleaning will be reduced, with a consequent monetary saving, but this is not half so important to the lady of the house as to be saved the continual worrying of looking after maids who frequently shirk their work, generally due to the amount to be done. Surely a few years' extra life due to less worrying are worth something to us.

When it comes to be generally realised how great are the advantages which electricity presents for heating and cooking over any other of its rivals, and its general adoption comes as a matter of course, then some of the smokiness of our manufacturing and residential towns will vanish. The streets will be cleaner, due to the absence of coal dust, and a nearer approach to Utopia will be possible than at present. Really, with a diminishing coal supply, some of the awful waste which takes place by our present method of heating and cooking, will have to be reduced if we have any real consideration for the welfare of the future generation and our nation generally.

There are numerous small electrical appliances which will reduce trouble and add to the comfort of life generally, and which you are sure to inquire into when once you find out the difference electricity will make in your house. Surely at the high pressure of modern times a little extra comfort is extremely welcome, and now that you have the agent that will give you this, there should be no reason why you should not adopt it, especially when it costs no more than the existing crude methods.

It is usually stated that experience is the best and only school to teach us progress, and as I am speaking from experience, I trust that this article will carry some weight with it that will make for the welfare of the home generally.

THE MUNICIPAL TRAMWAYS CONFERENCE.

The tenth annual Conference of the Municipal Tramways Association opened at Glasgow on Wednesday, September 27th, with a meeting of the executive committee at the City Chambers at 10 a.m.; thereafter a reception of the delegates and members was held by the Lord Provost and the Convener and members of the Glasgow Tramways Committee in the Council Chamber.

Lord Provost Sir Archibald McInnes Shaw welcomed the Municipal Tramways Association to the city, and trusted that their stay might be of benefit to the industry and pleasure to themselves. Subsequently the President, Mr. James Dalrymple, the general manager of the Glasgow Corporation Tramways, read his presidential address.

After recalling the fact that the M.T.A.'s second conference was held at Glasgow in 1903, with Mr. John Young as its first President, and that it was perhaps the smallest of the various associations of tramway men, he—with considerable truth—urged that in practice this was an advantage rather than otherwise. Large gatherings are apt to be unwieldy, and we can bear out the President's conclusion that in its smaller way the Association can make these meetings of greater practical value to the members than the larger bodies are able to do.

He went on to say that since the Association was formed in 1902 it had tackled every conceivable subject connected with tramways. For some years past he had been of the opinion that when a large and comprehensive subject was brought before the Association, the benefits derived from the short discussions thereon were scarcely sufficient to warrant the great amount of time and trouble expended in the preparation of the papers. He had, therefore, been anxious that the members should take up what might be termed the small change of tramway management.

He mentioned, as an instance, the subject of track construction and maintenance, which might be sub-divided into a dozen sections, each sufficient in itself for a good debate. The revenue side of the business is carefully watched, and the President is evidently of opinion that the expenditure side should have equal attention—as, we believe, it usually has.

The President, in conclusion, touched briefly on several other topics familiar to tramway men.

The President's desire for the continuance of the good work carried on by the Association will be generally shared by those in any way connected with electrical tramway work, and by none more than the technical Press, which did such good work for the tramways in the early days—but which nowadays does not, perhaps, receive the courteous recognition to which it is entitled at the hands of the Association.

At the conclusion of the Presidential Address, Mr. C. J. Spencer, Vice-President of the Association, in moving a vote of thanks to the President, said that the address just listened to might be described as "brief, bright, breezy, and—thorough." The railless systems in Bradford and Leeds had been a great success, and the only serious trouble they had had was to find a proper name for the system, whether "railless trams" or "trackless trolley."

Mr. Dalrymple, in his reply, stated that the executive committee of the Association were devising schemes for submission to Parliament in order to enable small local authorities to obtain powers for railless projects at less trouble and expense than the present procedure entailed. He called upon Councillor Walter Nelson, the sub-Convener, Glasgow Corporation Tramways Committee, to read his paper, entitled "The Common Good of the City of Glasgow, its origin, history and present position in relation to the Tramways Undertaking."

This paper is largely historical and wholly concerned with municipal finance in Glasgow, especially as regards that somewhat mysterious and reputedly wealthy fund known as the Common Good, the precise nature of which is now explained, although its credit balance still remains a mystery.

The following definition in the paper of the fund is perhaps as good as any:—"It is the common property of the citizens of Glasgow administered by the Corporation and to be used for the general benefit of the community, and as to the control and expenditure of which the Corporation are not fettered by statute."

The Common Good dates from the time when Glasgow was made a burgh; for the year ended March 31st last, the expenditure from the fund was over a million, but its revenues sufficed to produce a surplus of £55,912. This is really all we learn of its present financial state, as Councillor Nelson maintains a discreet silence in regard to the Common Good funds at disposal at the civic bankers.

The paper is of some interest, in that the Corporation tramways undertaking is, and always has been, part of the Common Good, and that its revenue and expenditure are in great part derived from, and due to the city tramways undertaking; so much so, in fact, that Mr. McElroy subsequently ventured the opinion that it would have been bankrupt but for the latter.

Tramway Finance and Policy.

(*Abstract of paper by* Councillor Jas. H. Rodgers, *Newcastle Corporation Tramways Committee.*)

There are some 88 Corporations who at the present time own and work their tramways, whilst there are some 86 others who own them; these are often a short length of line in small urban or rural districts, which are rented or have a working agreement with larger corporations or private companies to work them in conjunction with their own lines. My remarks will therefore be confined to the 88 who are at present working their own tramways. We ought not to be satisfied with the knowledge that some 30 of the 88 tramways may be financially sound, whilst the other 58 are either struggling to make ends meet, or are kept going by the assistance of the rates.

I have frequently been amused at these conferences, and elsewhere, by hearing speakers give figures in bulk to prove that the municipal tramways of this country are a financial success; the only correct way, to my mind, is to take separately the financial position of each concern.

The first consideration of a Tramways Committee ought to be to make their undertaking financially sound, by the building up of a sufficient reserve and renewal fund.

Their second consideration, to see that the travelling public is supplied with proper accommodation and facilities.

Their third, to see that good conditions of labour are given to all their workers.

And their fourth consideration, to see that when the first three are complied with the ratepayers who backed their bill and over whose streets they run their cars, should have some return in the shape of contributions towards the rates.

No fewer than 26 of our municipal tramways undertakings are to-day without any reserve or renewal fund at all, whilst many of the others are far from satisfactory in that respect. In coming to this opinion I have not set up a high standard and then judged them by it; I have really taken a very low estimate of what, in my opinion, the reserve and renewal fund ought to be.

By some committees provision is being made in their reserve fund for the depreciation of everything—track, car-sheds, rolling stock, machinery and overhead equipment; whilst in others, and I believe this applies to most places, car-sheds, rolling stock, machinery and overhead equipment are kept up out of revenue, and provision is only attempted to be made in their reserve fund for track renewals. It is from the latter basis that I propose to judge the financial position of our municipal tramways.

The money for the track is borrowed over 30 and sometimes 40 years. While the foundation may last that time, I think everyone will admit the rails won't, and will need renewing long before that period is passed. This is demonstrated very clearly by the following list, which shows the amount spent on renewals by the places named since their tramways commenced:—

	Amount spent.	Years opened.
Aberdeen	£45,024	12
Bradford	84,397	12
Bolton...	53,091	11½
Birmingham	11,803	4
Burnley	7,770	9
Cardiff...	9,255	9
Dundee	8,350	10
Glasgow	238,083	10
Huddersfield	124,615	10
Liverpool	190,321	12½
London County Council ...	45,248	12
Manchester	224,932	9½
Portsmouth	25,310	9½
Rotherham	9,894	8
Newcastle-upon-Tyne ...	10,817	9½
Salford	19,051	10
Sheffield	122,529	11½
Sunderland	26,830	10½

Every penny of this money was spent out of their reserve and renewal funds.

How, then, will the 26 places renew their track when it becomes necessary, which have no reserve fund at all?

I certainly think they would have been well advised if they had built up their reserve funds, even though it had required a rate to do this.

It is satisfactory to see that about 67 of the Committees are attempting this. Many, I submit, do not place sufficient each year, thus their reserve and renewal funds are far from adequate. It is still very pleasing to know that they accept the principle.

We ought to take an average life of 15 years for the rails. It is generally accepted that the net cost of relaying will be about £4,000 per mile of single track, but experience shows it is frequently higher. The Inland Revenue authorities, who are never eager to make allowances, have agreed, I think, to the allowance of £4,400 per mile of single track for this purpose. In one town I find the cost of relaying a little over 6 miles was £33,000, which is over £5,000 per mile.

What I suggest is that £200 per mile of single track ought to be set aside each year, and if that amount was invested at 3½ per cent., in 15 years you would have £3,800 for each mile of track, and thus be able to relay your rails as they were required.

It must not be overlooked that all the money would not be invested during the 15 years; some of it would be drawn out long before the time had expired to relay those places that had worn out quicker than the others, and thus the interest on such money would not be earned. In that case the money would not represent £3,800 per mile, but something less than that amount.

Some Tramway Committees have in the past given their profits over to the rates, and now that renewals have to be done their income is not equal to the increased expenditure, with this result—that the present-day ratepayers have to make good the loss.

Last year 34 tramways showed a loss on their year's working; this is an increase of five over the previous year. I greatly fear that the list will be considerably extended unless some of the Committees alter their present policy of handing over all, or the greater part, of their surplus to the rates, and of granting further concessions to the public and their workmen; the incomes of their systems will not allow them to do so.

The author gives a list of 30 tramway undertakings which are, in his view, doing well, only three of which placed less than £200 per mile to renewals; this is followed by a list of 14 undertakings doing moderately well, but which, the author considers, were not justified in contributing to the rates as they have done. A third list is of 16 tramways which show a surplus which is insufficient to provide £200 per mile; and a fourth gives 32 undertakings which show no surplus at all, only three of them not being a charge on the rates.

In regard to the fourth list, the author says it is surprising to find such a small traffic return, notwithstanding that many of the places have adopted the half-penny fare stages which are *supposed* to increase traffic, if not receipts.

He continues: I am a great believer in Corporations owning and working their own tramways; but I also believe that, when it is done, it ought to be done on purely business lines.

Any chairman or manager will tell you that, at the present time, it is almost impossible to do this. You have members of the Councils voting away the profits to the relief of the rates, irrespective of any future requirements in the way of renewals.

There are others who contend that the ratepayers are not entitled to any financial assistance by contributions towards the rates. With this I entirely disagree. The ratepayers have a right to expect a return sooner or later; the streets belong to them, and by placing the tramways in those streets they give them a marketable value.

I believe in giving every facility possible to the public, consistent

with the yield of an adequate profit; but I do not see why we should run cars at a loss, or even at a loss of profit, for the sole benefit of the riding public, when frequently one-third or more of those using our cars may be non-residents in our districts.

In no fewer than 12 towns where losses are made each year, the Committees have granted ½d. fares; whilst in six others, where the profits are not sufficient to make proper provision for track renewals, the Committees have made the same concession.

In only ten places that may be looked upon as financially successful are ½d. fares allowed; four of these are in Scotland, which, of course, includes Glasgow, and four are in England, viz., Leeds, Sheffield, London (L.C.C.) and West Ham, each serving very large populations; the remaining two are Stockport and Warrington, both of which, I feel sure, would have done better if they had never granted the concession at all.

In the numbers given above I do not refer to workmen's cars, but only the ordinary daily traffic; nor do I include Manchester, with a circular route with ½d. sections on the outskirts of the city; or Halifax, Preston and Perth, with one short route only at that fare.

This goes to prove very clearly, I think, that ½d. fares ought not to be given, especially by small tramway systems; even the larger ones should be exceedingly careful before granting such facilities.

I shall now refer to what I consider another mistaken policy which some of our Committees have adopted, viz.: the running of cars at cheap fares each morning. I notice in several towns they allow all passengers to travel at half the ordinary fare up to 8 and 9 o'clock in the morning, issuing return tickets at the same rate in many places; that, to my mind, is undoubtedly a great mistake and a decided loss to those undertakings.

We all, I believe, excepting six towns, run workmen's cars; I wonder how many make them pay; very few, I should think, if any.

The loss may not be felt so much by the larger undertakings, but where tramways are established in small, thinly-populated districts, and where revenue is of the greatest importance to them, it then becomes a very serious thing; it is one of the several causes that leave those undertakings with a debit balance each year.

I fully recognise the difficulty there might be in correcting all this now that the concessions have been granted; but, in my opinion, this should be done by those tramways committees who are running their service at a loss, and are already a charge upon the rates; the financial stability of their undertaking certainly demands it.

The author refers to the question of the employés and their conditions of work; he says that if a comparison is made between the skilled mechanic and tramway man, "it will be found that the wages and emoluments of the latter, who are generally drawn from unskilled labour, will equal the net income of the skilled artisan; to place him higher still, either by granting more wages or by reducing his hours of labour, would be not only an injustice to the trained mechanics, but quite unfair to the undertakings we have to manage and direct."

He concludes with a shot at the would-be popular members of the council or committee, who are never happy but when advocating further concessions, and a tabulated summary relating to capital, income, &c., of the various tramways for 1910-11.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Quartz in Electrical Heaters.

We are surprised to read in your current issue a letter from your correspondent Mr. Alfred A. Newman, intimating that "Mr. Bastian can unblushingly (*sic*) claim to have been the first to successfully apply quartz" in the construction of electrical heating and cooking apparatus. Unfortunately for your correspondent, however, facts do not bear out his assertion, which to anyone at all acquainted with the subject would be characterised as absurd and preposterous. Quartz or silica has now been used, we have reason to believe, for over 10 years in the construction of electrical heating and cooking apparatus, and there are at least a dozen firms in various parts of the world who are now using this material for this purpose, some of whom have been using it continuously for the full period mentioned, and, we may add, quite successfully. The Thermal Syndicate, Wallsend, and Messrs. Johnson, Matthey & Co., London, have been manufacturing this material on a commercial scale in this country for about eight or nine years, but it has been used in Germany for a longer period than this. Herren Heraus, of Hanan, Germany, we believe, were the pioneers of this material for electrical heating purposes.

In addition to this firm there are also others in Germany, among whom we may mention the Brockdorf Witzemann Co. and the Kryptol Co., Berlin. In America, among the firms who have been using this material continuously for electrical heating purposes for the past six or seven years to our knowledge, we may mention the Hoskins Manufacturing Co., Detroit, and the Bristol Co., New York. In this country we have been using this material in the construction of electrical heating and cooking apparatus for the past six years, and it has also, we believe, been used by some other firms; Gallenkamp & Co., London, if we remember aright, were advertising some electrically heated appliances about six years ago, in which a tube of quartz wound with a coil of pure nickel wire on its external surface was employed. The use of pure nickel as an electrical resistant material is, however, fatal to success, and this was recognised years ago. The type of heating element we (and others) have been using for temperatures from a red heat up to 2,600° F., has been a thin-walled tube of quartz, alundum, or porcelain, wound on its outer surface with a coil of platinum iridium, nickel-chromium, or cobalt-chromium alloy resistant ribbon or wire. Mr. Bastian's patent, dated 1908, merely covers a detail of construction, viz., in place of threading or winding the resistant coil or spiral over the outside of the refractory insulating tube, he threads the coil inside the bore of the tube.

Whether this constitutes an improvement on the older method of construction is open to question. So far as our experience goes, we find that the former and older arrangement is perfectly satisfactory, while there is certainly no difference in the efficiency, the whole of the electrical energy being converted into thermal at any desired temperature up to 2,600° F., which is about the maximum temperature quartz will endure for any length of time. We may point out to your correspondent that success or failure in this direction is not so much influenced by the use of quartz alone, as he seems to suppose, but by the use of a suitable electrical resistant material. Up to about six years ago, although others were known, the only successful electrical resistant materials available commercially, capable of enduring a high temperature, were platinum and iridium. The excessive cost of these materials, of course, rendered their use in electrical heating and cooking apparatus somewhat limited, and prevented any considerable sale of the appliances. About this time the Hoskins Manufacturing Co., Detroit, developed the manufacture of an alloy of nickel and chromium, which they christened "Nichrome," especially for use as a resistant material in electrical heating and cooking apparatus, and they, and other firms, have been using it ever since.

The Hoskins Co. filed a patent specification in this country (No. 2,129, of 1906), but the Patent Office endorsed it with a reference to a previous Patent No. 202, of 1896, by Emile Placet, of Paris. This gentleman was undoubtedly the inventor of nickel-chromium alloy, and we believe that the Hoskins patent has since been abandoned in this country. This alloy of nickel-chromium possesses the peculiar property of being inoxidisable at a bright red heat, and comparatively cheap as it is, has probably been the greatest factor in making popular those electrical heating and cooking appliances, such as toasters, radiators, grillers, &c., requiring radiant heat for their operation.

There are other refractory insulating materials, such as alundum, steatite, porcelain, &c., which will give as good results as quartz, but, as it happens, quartz is cheapest. The use, however, of either platinum, iridium, nickel-chromium, or cobalt-chromium alloy is vital to successful operation. Mr. Bastian was apparently not aware of this fact, or of the existence of the above-mentioned alloys, as in his Patent Specification 19,333, of 1908, he mentioned that pure nickel was the best material to use for the heating spiral. That one contention that the electrical resistant material is of more importance than the kind of refractory insulator used is proved by the fact that Bastian's apparatus when first introduced employed nickel spirals, and, in consequence, proved unsuccessful; success was only attained when nichrome spirals were substituted for the nickel. The use of nickel was, in fact, distinctly retrograde to the extent of fully ten years. It is a matter for regret that patentees before placing their inventions on the market

do not make a point of making themselves fully acquainted with what has been done previously in the same direction, as the introduction of crude devices, especially when backed by ample capital, has a tendency to stop the sale and otherwise spoil the market for more perfect appliances, by their unsatisfactory operation. Another instance of this kind occurred only a few weeks ago in the columns of your journal, where Messrs. Isenthal pointed out that they had been using heating elements composed of a resistant wire threaded into beads ten years ago, and discarded the device, which was being re-introduced by another firm as new. A combination of quartz as an insulator with nickel-chromium as an electrical resistant material was early seen to be advantageous in the construction of electrical heating and cooking apparatus, and has been adopted by a number of firms, but we are not aware that the combination has ever been claimed as the monopoly of any particular firm.

Paterson & Co.

Newcastle-on-Tyne, *September 25th*, 1911.

Trade Discounts to Private Customers.

Re the correspondence sent you by Messrs. Wm. Coates and Sons, Ltd., published in your last week's issue, I should like to know in what way Messrs. Coates think they are placing Mr. — in the pillory. Candidly, I do not consider that they have stated a case; they are offered 10 per cent. by X. & Co. for doing absolutely nothing, and this ought to be enough for them in the circumstances, even if they had sent Mr. — to X. & Co.

As regards X. & Co.'s behaviour in the matter, I fail to see how any exception can be taken to this, more especially as if they had invoiced Messrs. Coates with the goods and the latter had disappointed them in payment, their only remedy would have been against the party who placed the order with them.

C. G. Fox.

Palmer's Green, *October 2nd*, 1911.

With reference to the correspondence you publish from Messrs. Coates & Sons, I think they will be wise to put their case before the secretary of the Contractors' Association. I have been "had" in the same way. Often my country house clients prefer to buy their own fittings in London, and ask me for the names of several fittings manufacturers. I have to be very careful what names I give, as some manufacturers will not reserve the trade discount for us unless the order is given in our name. On the other hand, some manufacturers—I might say the majority—are quite the reverse. I have just had a full credit note from Messrs. Galsworthy for the trade discount off some fittings that one of my country house clients brought for his London house, that I did not know anything about.

If all the contractors belonged to the Contractors' Association, it would save us a lot of trouble and expense.

A. F. Lord.

Plymouth, *October 2nd*, 1911.

Electric Power First Used in Collieries.

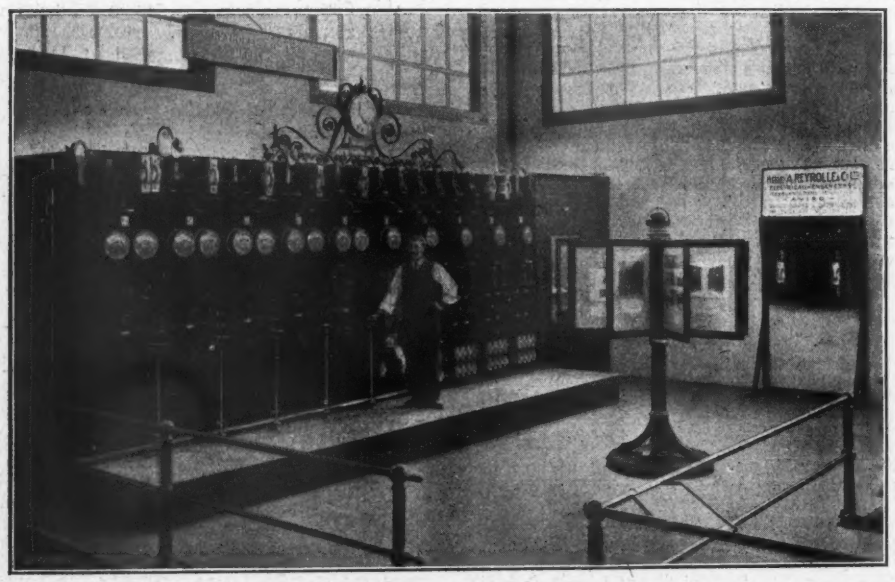
I should be much obliged if you could kindly inform me at which colliery in Britain, and also in the world, the first electrically-driven pump and haulage gear respectively was in use in the mine.

Arthur O. Neal.

Carlisle, *October 1st*, 1911.

SWITCHGEAR AT THE TURIN EXHIBITION.

In our leading article last week on the International Exhibition at Turin, we commented upon the meagreness of the British exhibits of electrical plant, and the absence of switchgear for pressures above 500 volts; it should not be supposed, however, that there is no British switchgear at the Exhibition. The whole of the British section is supplied with direct current through a large switchboard made by Messrs. A. Reyrolle & Co., Ltd., of Gateshead, which we illustrate herewith. This is a fine example of what we can do in this line, and bears witness that one firm, at any rate, has made a strong endeavour to uphold the reputation of British switchboard manufacturers at Turin. The set of mounted photographs seen in the foreground illustrates the company's other principal productions, including their well-known high-pressure ironclad switchgear, and switchgear for mines, &c., with descriptions in Italian, French and English—an admirable example of the way in which these things should be done.



Reyrolle Switchboard at Turin.

Legal.—An objection was raised in the Court of Chancery on September 27th, to the order dissolving an injunction obtained by a ratepayer. The motion was issued by Fleetwood District Council to dissolve the injunction obtained by Mr. C. Drummond, a ratepayer in Fleetwood, on June 21st, 1908, restraining the Fleetwood Council from applying their funds towards assisting Thornton Council, in carrying forward litigation respecting the assessment of Blackpool and Fleetwood Tramroad. The Deputy Chancellor directed the order dissolving the injunction not to be drawn up for a week, and not then if notice of any person opposing was served upon the parties.

WORKSHOP LIGHTING.

By Wm. MANKTELOW.

The adequate and well arranged lighting—by day and by night—of workshops is as hygienically essential as the provision of proper sanitation and ventilation, but even to-day this fact is imperfectly realised. Very ill-planned lighting schemes are often installed, and outlay is unduly restricted by failure to recognise that its investment would be amply repaid by the greater and better output obtained, and the better health secured to the workers. When compared with the huge capital invested in buildings, power plant and machinery, the expenditure required to provide satisfactory illumination throughout a works is absurdly trivial, and is, moreover, little greater in the case of a scientifically designed equipment than in that of the inefficient installation so often considered adequate. The mere provision of a suitable lighting scheme must, however, be followed up by a systematic and thorough system of inspection and maintenance.

The golden rule of factory and workshop lighting must be to apply just enough light, of the right kind, in the right manner and at minimum cost, and then to maintain the working conditions at their initial level of efficiency.

The present notes are devoted to a consideration as to how these desiderata may best be realised.

Deficient lighting, whether as regards total amount or distribution, will lead to eye troubles—notably myopia—in the person working under it; will greatly increase the risk of serious accidents,* and will appreciably reduce the quantity and quality of the output from the workshops concerned, as well as causing psychological depression in the employés. So important are these factors, that all lighting installations should be regulated wholly by the nature of the building and the work carried on and by the nature and position of the machinery employed, and not by considerations of wiring and installation convenience.

The degree of accuracy required in modern manufacture calls for the provision of excellent illumination in all workshops to enable its attainment, and, though artificial lighting is normally required in factories only for a few hours per day (varying from two to six hours, according to trade and season), this amounts to 15-35 per cent. of the total working hours (54-90 hours per week), and, moreover, embraces mainly those hours in which the employés, tired by their day's work, need more than ever the provision of conditions favourable to efficient output. Among the remaining advantages to be derived from the good illumination of workshops may be noted the incentive to personal cleanliness and increased facility of efficient overseeing.

Legislation and Adequate Illumination.—In spite of the transcendent importance of this matter, it will be found that few States have enforced any statutory requirements as to the illumination provided in various workshops. Nor is the reason far to seek; it lies wholly in the very different circumstances of various manufactures and industries. What is adequate illumination for one purpose is too great for another, and as much too small for a third. In the present state of illuminating engineering, it is perhaps as well that most countries content themselves with requiring an "adequate" illumination in their workshops, leaving to the discretion of their factory inspectors, or similar officials, the decision as to whether or no this condition is conformed to in individual cases. "Adequate" illumination may be taken to mean that which allows of maximum perception of the work in hand with minimum eye strain to the worker. Excessive illumination is as far removed from "adequate" lighting as is insufficient illumination. Thus, small print, indistinguishable or distinguishable only with difficulty at 0·1—0·2 candle-ft., is best deciphered under an illumination of 1½—4 candle-ft., and becomes again illegible at the higher illumination of 8—10 or more ft.-candles.

Desirable as some guiding statutes may be, which would enable the provision of at least a certain minimum illumination in various instances where the inevitable looseness of the term "adequate" is open to abuse, such precise legislation is at present impossible, and all that can be done is to determine the actual illumination in as many definite cases as possible, note *by experience* whether it is sufficient or not, and thus gradually approach a reliable basis for legislative action in the various services examined.

Holland and Switzerland appear to lay down the most definite regulations concerning the lighting of workshops, and even their requirements on this point are very loosely framed. Thus, a Dutch Royal Decree specifies not less than 15 bougie-metres (about 1·5 ft.-candles) of illumination in certain trades,* and not less than 10 bougie-metres (about 1·0 ft.-candle) in "other works requiring good lighting." The Swiss Federal Council contents itself with certain definite requirements concerning window area and arrangement (see later), and the broad statement that "workshops must be provided throughout with '*satisfactory*' natural and artificial illumination." Our own legislation variously calls for "adequate" lighting and "efficient means of lighting, both natural and artificial." It will be noticed that the provision of natural lighting is throughout (very properly) considered as of equal importance to the provision of artificial lighting.

Considerably more detailed reference will have to be made to this point in a later paragraph, for, however widely it may be recognised by legislators and inspecting officials, it is still imperfectly realised, or at least neglected, by numbers of architects, contractors, and works managers.

In the suggestions made by the Incorporated Society of Medical Officers of Health, to secure uniformity under the Factory and Workshops Acts as applied to underground bakehouses, &c., may be noted an interesting attempt to specify a standard of illumination. It is suggested that the natural lighting should be such "that an official copy of the abstract of the Factory Act may ordinarily be read in all parts of the bakehouse between 11 a.m. and 3 p.m." This rule, though obviously somewhat crude, is a simple and practical means of attacking a difficult problem pending a more satisfactory and complete solution.

Illumination Desirable.—The general drift of the preceding paragraphs has been to show how impossible it is to state definitely what illumination is sufficient for various purposes, hence the following figures must be regarded merely as a useful guide, the final decision in each particular case being directed by local conditions and circumstances. It may be noted in the first place that by a very generally adopted convention, "bright" illumination means an illumination of more than 4 or 5 ft.-candles; "medium" illumination implies from 1 to 4 ft.-candles; and "low" or "dim" illumination means less than 1 ft.-candle. The use of such terms is liable to lead to confusion, since the various "code" words are apt to be used casually and in places where their arbitrary significance, as above fixed, is not intended; again, 4 ft.-candles, too bright an illumination for some services, is insufficient for the examination of many dark goods, and so on. Vague as many of the dicta of illuminating engineering must be for some time to come, it is unwise to accentuate this incertitude by unnecessary conventions.

In well-lighted workshops, the natural illumination near the windows should certainly not fall below 4 or 5 ft.-candles, while by artificial light, for reasons discussed later, 1-1½ ft.-candles will usually suffice, and even ½ ft.-candle may be sufficient in some cases. Bearing in mind the requirements already noted, the figures given in Table I may be taken as fairly representative of modern† practice.

In any lighting scheme employing illumination higher than 3 or 4 ft.-candles, special care is necessary in obtaining proper diffusion, particularly if the work handled is glossy or polished (see later sections).

Natural Illumination.—The provision of adequate natural lighting in a workshop or factory requires no less care than

* According to some recent returns, 75 per cent. of the accidents in factories happen after 4 p.m., i.e., during the period in which artificial light is more or less employed.

* Embroidery and sewing; mechanical knitting and quilting; draughtsmanship; printing; engraving metal or wood; manufacture of instruments; clock and watch repairing; working in gold and silver or precious stones.

† That the qualifying adjective "modern" is necessary is proved by the steady increase in the illumination demanded for various services during recent years. Some of the increase has been necessitated by the greater delicacy of the processes involved, but a considerable part has merely followed the general tendency to higher illuminations, which has formed a prominent feature of the "education of the public

the arrangement of its artificial illumination; indeed, the former problem presents certain special difficulties of its own, which become ever more embarrassing in these days of close and high building (the overhead skylight being, of course, definitely fixed under all circumstances). The modern single-story factory, built on the "bay" system and lighted

TABLE I.—Average Candle-Feet of Illumination Desirable in Various Places, and for Various Purposes.

Foundries	½-2	Various presses	3-3½
*Spinning sheds... ...	1½-2	Printing; type setting, &c.	4-5
*Weaving sheds from 2½-3 (light goods) to 3-4 (dark goods)		Inspection department from 4-4½ (ordinary work) to 5-10 (dark goods)	
Offices (ordinary commercial) from 2-2½ to 3½-4		Milling and automatic machines 5-7 (at work) 1-2 (over rest of m/c)	
Offices (drawing) ...	4-6	Lithography, engraving, &c.	5-10
Store rooms	2-5	Fine enamelling... ...	5-10
General engineering shops from 3-4† to 3½-5‡		Aligning and fine adjusting	10
Grinding and tool department	3		

* In textile factories in the past illumination has been very insufficient and badly arranged. Most of the processes of manufacture and inspection are very trying to the eyes, and the result of past neglect has been a great deal of eye-trouble with the operatives.
† Large rough work.
‡ Ordinary small work.

by "skylights," is a comparatively simple subject for the illuminating engineer; but in the older many-storied buildings, still so largely in use (and likely to remain so owing to the costliness of the surrounding ground), great difficulty is usually experienced in obtaining access to every part of the shops for the daylight which is so essential to the health of the workers.

In many works, provided with the most elaborate and satisfactory means of artificial lighting, the natural lighting is very defective; in most of such instances its improvement would be a costly, if possible, process; but it should be remembered that no artificial light possesses the full hygienic value of sunlight. The latter is invaluable in opposing anæmic tendencies and in the extermination of bacteria of every kind.

In all cases, and particularly where the total natural illumination is small, it should be noted that a given area of "high angle" window space is enormously more useful than an equal area drawing its light from a patch of sky low down on the horizon. It is for this reason that glazed roofs give such powerful natural illumination, and it is for this reason that all wall windows should be carried as high as possible in the rooms which they illuminate. This important principle is recognised in the Swiss Law of December, 1897, which decrees that "in new factories and reconstructed buildings of this class, all windows shall be at least 1·80 metres (5·90 ft.) high, and their distance from the ceiling shall not exceed 30 cm. (say, 12 in.)"; wide low windows, high set, give the maximum natural illumination per sq. ft. of aperture, but such a shape should never be used when the windows must be low set.

Underground workshops may be "naturally" lighted to a certain extent by skylights set in embrasures at intervals round the walls, the lights being in the pavement or ground plane (this assumes that ordinary windows, facing into light "wells," cannot be employed). The skylights should be glazed with prismatic glass, and beneath them should be placed an inclined bank of glazed white tiles—which must, of course, be kept very clean.

In other instances of overground workshops, prevented from obtaining adequate natural illumination by the close proximity of other buildings, prismatic glass may be used in the windows and will generally yield a better light distribution, and in a more pleasant manner, than the ordinary ribbed mirror, which is often hung outside the window at an angle of about 45° in such cases. Whichever be employed—prismatic glass or reflecting mirror—great care must be taken that the incoming light does not distress operators at the neighbouring benches or tools.

Where possible, a high-angle illumination should be obtained from a northern aspect, the well-known saw-tooth roof—so generally adopted in modern single-story factories—lending itself admirably to this requirement. Remembering the advantage of a high angle of collection of daylight, it will be seen that in place of the usual arrangement of saw-tooth roof (fig. 1) it would be much better to glaze the flatter pitches (fig. 2), a far more powerful (and equally uniform) illumination being thus obtained—area for area.

Fig. 1.

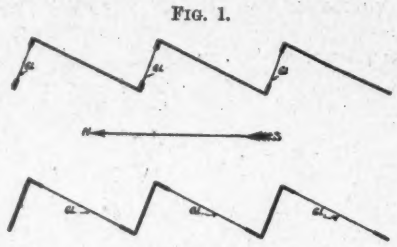
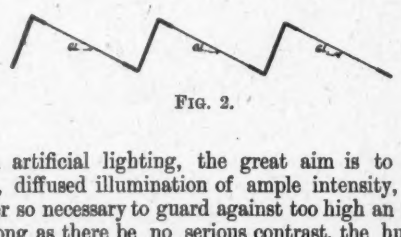


Fig. 2.



As in artificial lighting, the great aim is to obtain a uniform, diffused illumination of ample intensity, but it is no longer so necessary to guard against too high an intensity, for, so long as there be no serious contrast, the human eye is able to adapt itself without distress to daylight illuminations varying over so wide a range as that from 5 to 100, 200, or even 500 ft.-candles (see also notes concerning the ratio between artificial and natural illumination). Diffusion of daylight is, however, as necessary as diffusion of artificial illumination, and though generally easier to obtain, special provision has to be made in special cases.

Artificial Illumination.—In designing a scheme of artificial illumination, the existing natural lighting must not be taken as a criterion either of sufficiency or of correct distribution; in both respects it will often be deficient, and possibly inevitably so, but in an artificial lighting scheme, there is excuse for neither defect, and the illumination must be designed quite independently of the daylight arrangements.

A considerably lower mean illumination should suffice at night than is necessary in daytime, owing to the greater sensitivity of the eye (a fact which may be noticed in ordinary domestic life as follows:—When the window blinds are drawn early, the artificial light substituted for daylight seems temporarily very insufficient, yet after a time it may seem painfully intense). It now becomes necessary, however, to guard against too great an illumination, for intensities which are tolerable by daylight become, by the greater sensitiveness of the eye, and the almost inevitably harsher contrasts under artificial illumination, quite unendurable by night.

Most machine tools require a comparatively intense illumination over one or more of their parts (*e.g.*, at the work in turret lathes), and, in addition, require a moderately strong general illumination:—(*a*) In order that oiling, adjusting and similar operations may be conducted in safety, and (*b*) in order that the contrast between the local intense light and the surrounding dimmer illumination may not be too great. Local intense lighting is *per se* undesirable, and should be reduced to a minimum, but, in most machine tools, the tool tip and the work itself demand an intensity of illumination which is unnecessary and undesirable over the whole area of the "shop." Moreover, this local illumination is generally of necessity adjustable to suit the work in hand; its provision is a relatively simple matter, and it is in the obtaining of a uniform* general illumination, as nearly as possible approaching daylight in its all-pervading nature, that the chief obstacles have to be overcome. The difficulties in the way of satisfactorily illuminating the lower portions of machine tools, tool beds overshadowed by a massive turret, or, in other cases, by a dye or varnish tray, and so on, have to be experienced to be appreciated.

Our desiderata, then, are a good general illumination and a set of more intense local lighting sources. Among the difficulties to be contended with are overhead obstructions, which, by hampering the erection of lamps and throwing conflicting shadows, impede the provision of an even general illumination, while, on the other hand, "local" lamps must be as far as possible under the operator's control, yet he must not be able to apply them in a manner injurious to his

* But not entirely shadowless, for all appreciation of relief then disappears—frequently with dangerous results.

own eyes or annoying to his fellow workmen. The three conditions to be avoided, or at least minimised, are :—

(1) Contrast ; (2) too high intensity ; (3) reflected glare.

"*General*" *Lighting.*—Even distribution and freedom from heavy shadows is best secured by using a number of high-candle-power lamps slung as high as possible. If the maximum height attainable still leaves the lamps too nearly in the normal line of vision of the workers, inverted lighting (with suitable top reflectors) must be employed ; in any case the latter, though costly, is the most satisfactory system

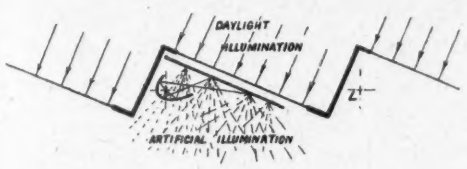


Fig. 3.

available. An excellent means of indirect lighting—applicable to most engineering shops, and particularly to those with saw-tooth roofs—imitates the natural lighting of the latter class by arranging arcs or mercury tube lamps behind opaque reflectors throwing the emitted light on to large white enamelled reflecting plates, placed as shown in fig. 3 (and, of course, arranged so as not to obstruct daylight illumination). It is then necessary to keep the whole reflector system very clean in order to realise efficient illumination.

The illuminating source should not be directly visible except at a great distance, otherwise the repeated accidental bright retinal images will, besides producing eye fatigue, make the apparent general illumination much lower than it actually is. Preferably, no luminous surface of higher intrinsic brilliancy than 5 c.p. per sq. in. (0·78 c.p. per sq. cm.) should be directly visible to the eye.

In the very high shops now so frequently necessitated by huge machine tools and overhead cranes, flame arcs, slung high among the roof girders, give an excellent "general" illumination. A yellowish source of light is generally preferable, though the greenish colour of the quartz mercury vapour lamp is admirably adapted to general engineering processes.* In any case the walls should be whitewashed, or at least finished in some light, efficiently diffusing colour.

"*Local*" *Lighting.*—The result which must, above all others, be avoided in local lighting, is the production of small areas of intense illumination immediately contiguous to comparatively dark patches. The only means of avoiding this effect is to provide no more "local" illumination than is absolutely necessary, and to secure as high as possible a "general" illumination. Every "local" lamp should be specially placed with regard to the requirements of the operator whom it serves ; it should be provided with an opaque metal shade, and should, in general, be capable of adjustment by the operator. In some cases it is preferable to fix the lamp once for all, so as to throw the best possible light on the "working centre," and in any case the operator should not be able to place the lamp nearer than 12 in. to the work he is viewing, otherwise the 16-c.p. lamp (which usually composes the unit) will give a harmfully intense illumination ; for a similar reason it should not be possible for the workman to replace the standard lamp by one of higher candle-power. Conical reflectors, white enamelled inside, are generally the best type to employ, being robust, efficient and free from the "streaky" effect given by all but the best polished reflectors. If each man be made to keep his own lamp and reflector in order, the efficiency of the system will be excellently maintained.

One of the greatest dangers to be averted in machine shop lighting is excessive reflected glare, which, even from dull steel, seriously fatigues workmen's eyes when intense local illumination is provided. This reflected light—possibly amounting to 10 per cent. of the incident radiations—together with the very intensity of the local illumination itself, often makes a far higher illumination appear necessary than would be required were a much lower intensity adopted in the first place. In other words, an intense local illumination will, together with its reflected glare, so fatigue the eye as to produce inferior perception to that obtainable with possibly $\frac{1}{10}$th-$\frac{1}{30}$th of the incident illumination.

The conclusions to be drawn from the preceding paragraphs are that a low local and a high and even general illumination should be provided, and all metal parts should, as far as possible, be covered with some dull paint ; a dull white would be preferable from an illuminating point of view, but, for obvious reasons, a dull slate or green colour is generally adopted.

Ratio between Artificial and Natural Illumination.—As already pointed out, a lower illumination should really suffice at night than is required by day, and that a much higher intensity actually appears necessary in many cases is due entirely to uneven distribution and too high local intensities. In support of this statement may be cited certain results abstracted from data obtained by L. B. Marks, in the course of tests made in a group of five American typewriter works. In all these factories the general illumination was very imperfect—usually varying in fact from less than 0·1 candle-ft. to 0·25 candle-ft.—while the local illumination provided at the various machines was injuriously intense. Thus, in several of the more flagrant examples, the normal daylight illumination, the local artificial illumination and the surrounding general illumination at night were as follows :—

TABLE II.

		Daylight.	Night.	
			"Local"	"General"
		Candle-feet.	candle-feet.	candle-feet.
Factory	1. Automatic screwing machine	2·3	15·0	0·25
	2. Milling machine	4·4	42·5	0·03
	3. Aligning department ...	65·0	250·0	0·25
	4. Enamelling department ...	21·0	150·0	—

Comment is hardly needed to emphasise the injurious conditions obtaining. These examples, though extreme cases, were typical of the mistaken lines along which the whole system had been installed. It was found that the night illumination at the majority of the machines equalled from 4 to 10 times that provided during the daytime ; the secret of the whole trouble was improper diffusion. On a certain 7-ft. bench, for instance, there was a 3,600 per cent. variation between the maximum and minimum illuminations ! In many departments the general illumination 3 ft. 6 in. above the floor was frequently only $\frac{1}{1000}$th of the local illumination.

As might be expected, eye troubles were common among the employés.

The Personal Factor in Workshop Lighting. — Under this heading may be grouped all those prejudices and foibles exhibited by the majority of workmen when any radical change is effected or proposed in the method of lighting their "shop" and their work. In the first place, few will acknowledge that an improved "general" lighting will minimise and, perhaps, obviate the necessity for many of the older "local" lamps : each wishes to have his own lamp and to be able to regulate its position according to his personal taste, and independently of what is good for his own and his neighbour's eyes. For this reason, because nine out of ten men will move their lamps so as to get the most intense local illumination possible,* and again, because the slack wiring and counterweights of adjustable pendants give an untidy appearance, throw many shadows and are liable to catch and be caught, it is often considered preferable to spend as much more on the general illumination of the shops as will render these troublesome local lamps unnecessary. Where such a course is economically possible, there can be no objection against it.† In many instances where local illumination is indispensable, and particularly where a bright

* In other instances (such as cleaning, dyeing, textile, litho. and colour printing works), an illumination as nearly as possible approaching that of daylight is necessary. Indeed, it may well be doubted whether the "restful" virtues of the green mercury light are as great as has been claimed, and whether, in general, it is ever wise to employ, without special reason, a monochromatic or strongly coloured light.

* Thereby straining the eyes, heating the head, impeding access to the work and increasing the danger of accidents.

† Napier's Motor Works (Acton)—among other important factories—are lighted throughout by high-slung flame arcs.

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background is necessary (*e.g.*, for a levelling or straightening process), good results may be obtained by using an opaque lamp chamber with a ground glass front, the lamps being set far enough behind the screen to prevent local bright patches on the latter or any direct vision, however blurred, of the filaments through the translucent material.

The importance of requiring every employé to keep his (or her) own lamp and shade in order, when "local" illumination is provided at each bench, has already been noted. The necessity for a uniform rule on this point cannot be too strongly emphasised, but once the workpeople realise the advantages of scrupulously clean lamp fittings, little enforcement is required.

Illumination Provided in Actual Workshops.—In addition to the data of Table II, dealing with conditions as they should not be, the figures given in Table III may be noted as representative of more satisfactory installations.

TABLE III.

	Mean illumination (ft.-candles).	Watts per sq. ft. floor lighted.
Foundries	1½-2	Circa. 0·8
General machine shops	3-10	1-2½
Manfrg. miscellaneous small machines and mechanisms { General ...	1	1·1
Local ...	5-10	—
Screwing machines (at die)	50-100	—
Sewing machines (at needle)	100-150	—
Commercial depts., showrooms, &c., from ...	3½-5	1-2
to ...	6½-7½	2-2½
Office tables: under lamp*	3-4	—
Ends of table	2-2½	—

* Supposed centrally hung.

(See also Table I and notes thereon.)

Although such rules must be used with extreme caution, it may be taken that 1 M.S.C.P. per 4 or 5 sq. ft. of floor area will give a suitable general illumination for most workshops, while 1 M.S.C.P. per 1 to 2 sq. ft. will, according to circumstances, give a sufficient additional "local" illumination.

Workshop Lighting Load: Competing Illuminants.—It has been tacitly assumed above that electric lamps have been used to provide artificial illumination in the various cases, and though this assumption does not influence in the least the general principles laid down, it must be clearly understood that electric lighting cannot claim even approximate monopoly in the illumination of factories and workshops. In all cases, and especially where ventilation is difficult or fire risks considerable, electric lighting possesses its well-known advantages of cleanliness, non-vitiation of air and immunity from fire and explosion risks, as well as such important additional merits as operative simplicity and reliability. The surprising cheapness of high-pressure coal gas, petrol air-gas and similar illuminants enables them to compete favourably with electric lamps in many "general" lighting schemes, though the heavy cost of mantle renewals often removes practically the whole advantage due to low energy cost. For "local" illumination, electric filament lamps can hardly be ousted from their position of superior safety and convenience, but there can be no doubt that ill-planned and badly executed work in the past has alone lost many "general" lighting schemes to electrical contractors. A number of lamps placed along the centre of gangways, bays and other similar positions (convenient to the persons installing the lamps) is not—except by accident—a satisfactory solution of the illuminating problem.

A further decided handicap to the progress of the electrical illumination of factories has lain in the fact that central stations have not been able to offer very favourable supply rates to even the largest factory lighting installations, since their demand usually persists for a few hours only, and coincides with the ordinary lighting and traction peak. The extension of electric drive to the factories concerned largely remedies this condition, by enabling them to give the central station a good day-load in addition to their lighting demand.

Where all-night working is practised, the preceding remarks do not apply, for the supply station can afford to lose something during peak hours for the sake of gaining a welcome load during the remainder of the night. In many such works, however, steam plant and generators are installed to enable "home generation"; naturally the works seldom desire to take advantage of the favourable lighting rates which could then be offered.

No mention will here be made of the absolute and relative costs of various systems of workshop lighting, the main object of these notes being to emphasise the extreme importance of sufficient and properly arranged illumination, and to discuss the conditions implied by these requirements, and the means by which they may be fulfilled.

COPYRIGHT.

We have already (on April 21st) alluded editorially to the first debate in the Commons on the Copyright Bill, but, in view of the importance of the subject, we return to it. The debate at the end of July brought out still more clearly the contrast between the treatment proposed for the intellectual property of an author or an artist and that of an inventor.

So far all criticism is overcome, and amendments were rejected by substantial majorities, which appear to us to be due more to Government influence than to an innate love of the measure on its merits.

Many members on the Government side of the House, as well as amongst the Opposition, regard the Bill as a check upon the issue of cheap literature and music. Mr. Booth, one of the most powerful critics of the Bill, moved an amendment confining its operations to works actually published; but this was negatived along with the other amendments, and copyright in lectures was also affirmed.

A long discussion took place on the application of the Bill to architecture.

It was remarked by Mr. Joynson-Hicks that the architect is paid by his client for his work, and is not necessarily affected financially by any partial or complete imitation of it.

Who can say if an architect's work is original or artistic? It is merely a matter of taste and opinion, and not of fact. How then can it be decided? The education of an architect consists largely in the study of existing buildings, and style is the successful adaptation of old ideas. The truly original in architecture generally means the bizarre and the unsuitable.

The Solicitor-General, in pressing the clause upon the House, pointed out how extremely difficult it would be for an architect to prove that his design was original and artistic; and that his copyright existed, and had been infringed. He said that success in an action for infringement of copyright in an architectural design would be very rare. This appears to us to be a very good argument against the clause.

What becomes of the existing provision for registration of design? It appears to us that with such an extension of copyright as seems to be involved in this Bill, it will hardly be worth any one's while to register a design. It was stated that the provision respecting architecture would not increase the cost of small houses. In this we differ from him entirely, and we are not surprised that Mr. Barnes, as a labour member, was moved to vote for the amendment by the speech of the Solicitor-General against it. As was remarked, this clause is bound to lead to endless litigation and expense, and the cost must fall, in the long run, to be added to the cost of the buildings, unless some philanthropist is going to be brought forward by Government who is prepared to pay the whole hungry horde of lawyers, experts and officials who will be engaged.

Sir G. Marks made it clear that under the Bill the architect is not required to register his design, so there is no possibility of knowing beforehand whether any given idea is considered proprietary or not.

You have to build your house and take your chance of some one coming forward to say that you have pirated his ideas or picked his brains. The debate on this clause was wound up by the Solicitor-General, who said that the Law of Copyright, as applied to other than literary work, was concerned with things that were artistic in quality; while, on the other hand, the Patent Law dealt with things of utility.

But he would like to ask, again, how can a judge and jury decide what is artistic? and how can two judges or two juries come to decisions on similar cases with any semblance of conformity?

Generalisations of this character in Acts of Parliament are prolific of lawyers' gains and litigants' losses. Take the case of a new form of sea wall or breakwater, or a bridge, designed by an architect or a civil engineer. Who is to say where the artistic begins or the useful ends? Or consider the main building of a central electricity station. Why should there be intellectual property, to be protected for 50 years after the designer's death in a certain pattern of different-coloured bricks or arrangement of windows, while the man that invented the most perfect mechanism within that building is deemed to have no rights in it, except that negation of property which is provided by the Patent Office?

Again, we can imagine plenty of room for litigation over the question, "Whose copyright?"

How many architects make their own drawings? The scientific frontier between the architect and his draughtsman will prove to be a delicate line to draw.

Once again we see the lawyer and the professional witness endowed, while the producer is spurned aside. Utility is nothing, or less than nothing.

The parasitical growths are watered and nourished, and the solid useful tree is strangled in their interests. The man who builds is exposed to attacks and must turn aside from a useful occupation, and engage a lawyer to defend him however monstrous the claim or baseless the action.

We have nothing to say against a reform of the Law of Copyright provided it is made practical, plain and simple, and that the benefits conferred are not given at the expense of the public. But we must always protest against that fatal delusion of the legal and academic mind that useful things do not demand the highest intellectual powers for their production, and we must reiterate our conviction that continued ill-treatment of those who think out the problems of material advancement, without which all the fine flowers of art and literature would become impossible, will end inevitably and speedily in national ruin and the defeat of all the cherished hopes of intellectual greatness.

Not to excel in this race is to fall back, and we shall certainly soon fall back unless inventors, engineers and men of science are relieved from the senseless and serious handicaps now imposed upon them.

When it is seen to what risk we are exposed by the stoppage for a few days of some of our railways, it can be realised, even by the least imaginative, that the application of science and invention in our daily life is the most important consideration for us all. In the competition of the nations it is a question of life and death.

BUSINESS NOTES.

Argentine Republic.—The following is taken from a Consular Report, recently issued by the Belgian Foreign Office, on the commerce of Argentina:—There are good openings in the Argentine Republic for all kinds of electrical goods connected with lighting, heating, locomotion, telegraphy, telephony and motive power. Dynamos of 110 volts and 65 volts are in great demand; the motors are continuous current, for 220 volts up to 2 H.P., and for 440 volts beyond 2 H.P. Electric fans are also used extensively.

Installation Contracts.—The following contracts were obtained by Messrs. W. M. Scarth & Co., electric power engineers, of Newgate End, Bishop Auckland, during last week:—

Auckland Carriage Works.—The whole of the motors, switchgear, cables and lighting of works.
Blackett & Son's Sawmills.—Arc and incandescent installation.
Bentley's Yorkshire Breweries.—Lighting of Black Boy Hotel.
Mr. C. Elderton.—The electric lighting and signs for the Eden Theatre and Theatre Hotel.

Catalogues and Lists.—British Petroleum Co., Ltd., 22, Fenchurch Street, London, E.C.—Brochure of 90 odd pages on the subject of liquid fuel. The ground covered comprises the following:—The advantages of liquid fuel, its use in the navy, its industrial applications, its use on railways, in stationary boilers, in internal combustion engines, and in electric lighting stations. The pages are brightened by a number of suitable illustrations, and we have no doubt that the booklet will be of some service to those interested in what has been accomplished and what can be done with liquid fuel.

Reduktor-Elektrizitats Gesellschaft, Frankfort, Germany.—Leaflet relating to a patent bell transformer for electric bells, alarm signals, &c.

Messrs. L. Andrew & Co., 2, Whitworth Street East, Deansgate, Manchester.—Leaflet giving prices of "Wrendal" metallic-filament and "Capella" carbon-filament lamps.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Attractively got up brochure giving illustrations and prices for the season of their "Aegma" lamps of different shapes, and for various voltages. Views of street lighting and church interior lighting effected by these lamps are given. A picture appears of a lamp used for street lighting which had a life of 6,090¾ hours, and was switched on and off 699 times.

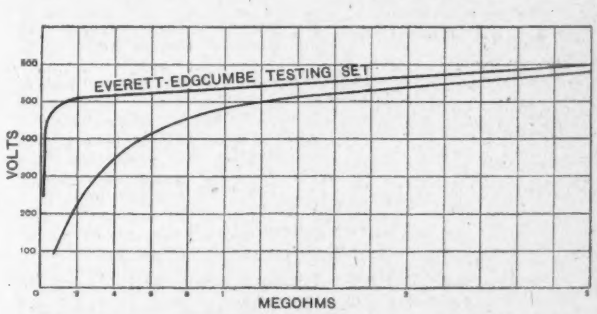
Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Two small booklets entitled respectively "Conduit Wiring Without Condensation . . . Kalkos System," and "A Universal Conduit Box." They form a brief and clearly illustrated account of the Kalkos system and the Sun screwed-tube system. Copies will be sent to any reader on application.

The Harris Patent Feed Water Filter (1910), Ltd., 24, Grainger Street West, Newcastle-on-Tyne.—Leaflet giving explanatory drawings and particulars of the Harris-Anderson patent water softener and automatic oil eliminator. A separate list gives the names of the numerous installations of their patent anti-corrosion system carried out for various electricity and other works, liners, &c.

The Cast-Iron Brazing Syndicate, 174, Dhurrumtollah Street, Calcutta.—Pamphlet containing an illustrated description of their cast-iron brazing process, and copies of testimonials from firms in India for whom they have employed it.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—Two new publications, Supplements 12 and 13 (Catalogue 506). The former contains illustrated description and prices of their latest design of pillar stand for X-ray tubes, of solid construction offering perfect protection to patient and operator, and having universal movements for use in radiography, radioscopy and radiotherapy. The latter deals similarly, but at greater length, with the "Oscillothermex" for the treatment of diathermy in its surgical and medical applications. The apparatus may also be used as a small X-ray and high-frequency plant, connection being made to one terminal of the tube only.

Modern Insulation Testing Sets.—Referring to the article by Mr. W. A. Toppin on this subject, in our issue of September 22nd, Messrs. Everett, Edgcumbe & Co. write agreeing that an insulation test, to be of any real value, must be carried out with at least double the working pressure, but at that most makers appear to be quite satisfied so long as their testing sets give the specified voltage on open circuit, with the result shown in Mr. Toppin's curves, viz., that, when testing comparatively low insulations, the pressure often falls to 30 per cent., or even less, of its nominal value. Messrs. Everett, Edgcumbe say they have always borne this matter most carefully in mind in



Relation of Testing Voltage to Resistance.

the design of their testing sets, with the result shown in the accompanying figure. The upper curve represents the actual pressure at the terminals of the insulation under test, when using one of their sets taken from stock, while the lower curve, which is added for the purpose of comparison, shows the pressure given by a testing set of another make, which will be seen to follow closely the lower curve given by Mr. Toppin in his article. The upper curve shows that in the case of their own set, there is, for all practical purposes, no fall of pressure until the insulation under test falls to about 30,000 ohms, a value hardly worthy to be called "insulation" at all. The instrument in question was of the self-contained (single box) pattern, so that, contrary to Mr. Toppin's suggestion, it is clearly quite possible to produce an ohmmeter and generator in one case, in which the specified testing pressure is maintained at the terminals of the insulation under test, throughout the whole range of measurement.

Dissolutions and Liquidations.—Havana Telephone Securities Co., Ltd.—A meeting is to be held at New Broad Street House, E.C., on October 31st, to hear an account of the winding-up from the liquidator, Mr. G. Banks.

A. Paxton and S. C. Fifoot, electrical engineers and electric supply merchants, Fynycoed Place, Cardiff, have dissolved partnership. Mr. Paxton attends to debts and continues the business.

New Lamp-Making Works.—There is a probability of an electric lamp factory being erected at Rugby. A Continental firm has asked for a site and promises to employ from 800 to 1,000 hands.

Book Notices.—"Report on the Fire at the Empire Palace Theatre, Edinburgh, on May 9th, 1911." By E. Marsland and M. Clarke. London: British Fire Prevention Committee. Price 2s. 6d.

"Electric Cranes: Their Design, Construction and Application." By H. H. Broughton. 1911. London: *Electrician* Printing and Publishing Co. Price 25s. net.

"*Transactions* of the Institution of Civil Engineers of Ireland." Vol. XXXVII. 1910-1911. Dublin: The Institution.

Bankruptcy Proceedings.—J. A. BAUER, electrical engineer, 17, Gracechurch Street, E.C.—Application for debtor's discharge is to be heard on October 25th, at Carey Street, W.C.

Trade Announcements.—MR. A. R. TURNER has resigned his position as chief electrical engineer to the Scottish Co-operative Wholesale Society, Ltd., which he has held for the last 10 years, and he is starting in business as a contractor for general electrical work, at 676, Eglington Street, Glasgow. He desires to receive catalogues and price lists, including those of ship lighting sets, fittings, &c.

The new address of MESSRS. S. BILL & CO., is 388 (not 387), Park Road, Hockley, Birmingham.

THE WESTERN ELECTRIC CO., LTD., state that their North Woolwich Works telephone number is now "3840 East" (10 lines), in place of "1400 East."

Market Quotations: Correction.—In our quotation of the price of English pig-lead last week, we incorrectly gave the figure £13 5s. per ton, instead of £15 5s. The latter being the correct price, there was an increase of 7s. 6d., as compared with a fortnight previously, instead of a decrease as shown.

LIGHTING and POWER NOTES.

Aldeburgh.—The undertakers of the E.L. order have applied to the B. of T. for permission to use overhead lines throughout the district, except as regards about 300 yards where underground cables will be laid, for the purposes of carrying out the order.

Bampton.—Steps are being taken to secure a supply of electricity for this parish. At a ratepayers' meeting Mr. Steele, of Exeter, explained a scheme for which a capital of £1,708 would be required, and a committee was formed to go into the matter, and to raise the necessary capital.

Barrow-in-Furness.—At the monthly meeting of the Corporation, held on the 2nd inst., it was decided, on the recommendation of the Highways and Lighting Committee, to replace existing gas lighting in Abbey Road, from the Central Station to the Furness Abbey tramway terminus, and also in Roose Road, from Salthouse Bridge to the tramway terminus, by electric lighting. This is to be by means of metallic-filament lamps suspended from span-wires fixed between the tram poles on either side of the road; the total length of road over which gas lighting is to be displaced is over two miles, and the number of electric lamps to be erected is 162. This decision has been arrived at as a result of a prolonged test between the two illuminants, in which the superiority of the electric lighting along the roads planted on both sides with trees has been very marked. Extensions of mains, at an estimated cost of about £900, are being carried out in connection with the supply of power to Messrs. Burt, Boulton & Haywood's sawmills at Devonshire Dock, where motors aggregating about 165 H.P. are being installed.

Basford.—It has transpired that the Stoke-on-Trent T.C., which proposes to supply current to Basford, has no power to do so, either in the town or on the Southlands Estate, where cables are already laid. The matter has been taken up by the local authority, the Wolstanton U.D.C., and the Stoke T.C. has undertaken that no further work shall be proceeded with until the matter has been further considered.

Bedford.—The T.C. has decided to have the electric light installed at the Isolation Hospitals, and has arranged to supply current to the C.C. for the new highway depôt in the town. The latter will cost £160 for connections, and the annual minimum revenue will be £50.

Belfast.—At the monthly meeting of the Corporation the question of the lighting of the new abattoir came up for discussion. As a deputation of the Gas Committee had waited upon the Market Committee to ask that the question of lighting the new abattoir premises by a system of high-pressure gas be favourably considered, the Market Committee considered the question, but passed a resolution voting for the installation of electric power and light. Councillor Dr. Trimble said there were objections to gas in the slaughter-house of the abattoir. Gas would also be unwise for the freezing apparatus. The city surveyor said he had prepared the specification for the electric light in accordance with what had been decided upon. With regard to the merits of gas and electric light, there was no denying that gas did give off fumes, and there was no question that the less fumes there were in the place the better. Another reason for the installation of electric light was that they would have to take in a supply of electric power, and they would take the current for lighting purposes also. Ald. Tyrrell thought it was to be deprecated that two departments of the Corporation should be pitted against each other. It was for the Corporation to say whether the new abattoir was to be lighted with gas or electricity, or both. The Corporation decided for electricity unanimously.

Brazil.—A decree of the Brazilian Government announces the reservation for the service of the State Railways of the waters of the River Coihain for 3 km., from its source downwards, and of Lake Chapo. This reservation will not affect the concession already accorded to Enrique Lang, No. 2,625, of December 16th, 1910.

A concession has been accorded to Messrs. Astoreca i Cia., of an intake equal to 5 litres per second from the Rio Loa for motive power purposes at their saltpetre works at Pampa, near Sierra Rencoret, Department of Antofagasta. A condition of the concession is that the State Longitudinal Railway is to be supplied with water by the concessionaire if called upon.—*Boletin de la Sociedad de Fomento Fabril.*

Bury.—Without any official ceremony, the new municipal electricity works, erected at Chamber Hall for the Corporation, have been opened, and a regular supply of power is now being given. The largely increasing demand for current for industrial purposes necessitated the erection of this station to supplement the Rochdale Road Works, and there is evidently a prospect of a considerable increase in the output for industrial work in the near future. In connection with the projected light railway designed to cover the districts of Bury, Heywood, Ashton-under-Lyne and North Manchester, it has been announced by the engineers responsible for the scheme that the Bury Corporation will be invited, along with the Ashton Corporation, to supply the electricity for operating the tramways. Last year's increase in the output for power purposes of 397,033 units, equal to 24·0 per cent., shows that manufacturers continue to appreciate the advantages of obtaining power from the public mains. The principal plant installed in the new generating house consists of two 2,000-KW. turbo-alternators, the turbines being of the Zoelly type manufacture, by Messrs. J. Musgrave & Sons, Bolton, and the alternators are by Messrs. Siemens Bros. Dynamo Works, Ltd. There are three boilers of the Woodeson type, manufactured by Messrs. Clarke, Chapman & Co., capable of evaporating 25,000 lb. of water per hour. It is interesting to note that the new works have been erected on the site of Sir Robert Peel's birthplace.

Carluke.—Gas consumers in Carluke are evidently believers in the adage that competition is the life of trade. They are up in arms against the charge made by the local gas company for meter rents, and have sent a petition from a public meeting to the company asking that such rents be abolished. At the same time they are petitioning the Clyde Valley Electric Power Co. to extend its electric supply to Carluke.

Castleford (near Pontefract).—A Sub-Committee has been deputed to report upon the question of electric lighting at the market hall.

Continental Notes. — AUSTRIA-HUNGARY. — Messrs. Ganz & Co., of Budapest, have secured a contract for the establishment of what it is claimed will be the largest power plant in Europe. This is being erected near Almissa for the Società per la Utilizzazione delle Forze Idrauliche delle Damazia, of Trieste. The water power of the River Setina is to be utilised, and although it is stated that no less than 200,000 H.P. is available, plant to the extent of only 40,000 H.P. will at first be put down, this comprising two sets of 20,000 H.P. turbines and generators. Trieste already has a 32,000 H.P. plant at Jaruga, supplying electrical energy to a carbide factory at Sebenico Dalmatia.

A syndicate is reported to be in negotiation for the establishment of works near Oberndorf, in the Tyrol, for the electrical production of steel. It is proposed to utilise the water power of the River Achauer Ache in connection with the scheme.

GERMANY.—The electric generating station at the "La Paix" works of the Société des Hauts-Fourneaux Lorrains Aumetz-La Paix, Lorraine, has been extended by the addition of two 3,100-H.P. gas engines and dynamos, in order to supply the current necessary for the operation of a rolling mill and a new finishing mill.

The Leitzachwerke Gesellschaft is the name of a new company which has just been formed in Munich, with a capital of £300,000, to establish and work a large central electric generating station; the municipal authorities of Munich are participating in the new undertaking to the extent of 51 per cent. of the capital. The Oberbayerische Ueberlandzentrale Munich has also been formed in Munich, with a capital of £115,000, this concern having entered into a contract with the Leitzachwerke to take its supply of current from the last-named undertaking.

FRANCE.—A new company has just been formed at St. Quentin (Aisne), with a capital of £48,000, and the title La Compagnie Electrique de l'Aisne, to control the distribution of the electrical energy for lighting and power purposes in the district supplied by the Compagnie Electrique du Nord.

Croydon.—On Tuesday, Mr. R. H. Hooper, of the L.G.B., held an inquiry into the application of the B.C. to borrow £10,000 for extending the electric supply by additional mains, sub-stations and transformers. The total capital expenditure on the undertaking to March 31st was £351,250, and yearly surpluses have been shown to the gross amount of £72,000. To date £22,000 has been allocated from profits to the relief of the rates. The Inspector, looking over the statistics presented by Mr. A. C. Cramb (borough electrical engineer) said the undertaking seemed to be in a very satisfactory position. He noted, as a special

feature of interest, that about 11 per cent. of the total receipts came from public lighting. The inquiry was purely formal, there being no opposition, and occupied only a few minutes.

Dunfermline.—In order to cope with increasing business, the Fife Electric Power Co. has introduced into the Townhill generating station a 2,500-H.P. B.T.-H. turbine set, almost a duplicate of the one originally installed at the works, and which was then the first of its type in Scotland.

India.—According to the *Daily Mail* a great innovation in Hindu customs has been introduced at Calcutta. After several sittings of learned Brahmin pundits and scientists, it was decided to light the Great Kalis Temple by electricity, it being considered that there is nothing objectionable in electric wires. The installation has been received with immense delight by the Hindu community.

Ingleton.—The P.C. has accepted the tender of the Electric Light Co., at £40, to supply energy for the lighting of the streets with electricity for a period of 12 months.

Itchen (Hants.).—A special meeting of the District Council has been convened for October 31st, to consider an application to the B. of T. for a provisional order authorising the Council to supply electricity for all public and private purposes throughout the district.

Johnstone.—There is a proposal before the T.C. for a scheme to provide electric power and lighting. The Corporation has reached the maximum production of its gas plant, and it is necessary to provide for the wants of lighting consumers.

Leyton. — At the last meeting of the Council the engineer reported that he proposed during the autumn to strengthen the main from Leyton Green to the Bakers' Arms by laying a duplicate upon the opposite side of the road, also to complete the gap in Canhall Road, so that the Forest Gate lighting can be supplied from two directions. This would take about 1,330 yards of '2 cable, for which he is to obtain quotations.

Lewes (Sussex).—The Lighting Committee recommends the use of electricity, instead of gas, in the principal thoroughfares. The matter is to be considered at the next meeting of the Town Council.

London.—Poplar.—The Electricity Committee reports that, at a recent conference of the sub-committees appointed by the Electricity Committees of Poplar and Stepney Borough Councils, the following heads of agreement were approved with regard to supplies of electricity between the two Councils: "(1) Stepney to afford supply to Poplar under the present agreement, pending Poplar extensions, to the year 1913. (2) Poplar to afford supply to Stepney from 1913 to 1917, or until such time as the maximum demand of Stepney reaches, say, 7,270 KW. (3) Stepney not to complete extensions until 1916 at the earliest date, or until the aforesaid demand of 7,270 KW. is reached. (4) After the period of supply by Poplar to Stepney, Poplar to be under obligation to take from Stepney equal bulk supply as Stepney has taken from Poplar, before Poplar makes further extension; Stepney, however, to have preference of extension at such time. (5) Three weeks' supply of coal, based on winter consumption, to be kept by each party immediately at hand." The Committee states that these proposals were in accordance with the agreement entered into with the Stepney B.C. for reciprocal and stand-by supplies, with a view to co-operation in the extension of plant to meet increased demands in the most economical manner for both boroughs. The adoption would involve the laying down in 1913, at an approximate cost of £20,000, of a further 3,000-KW. turbine generating set, with boiler power, &c., for the accommodation of which provision has been made in the scheme for extension of the electricity station buildings, already approved by the Council. It would also be necessary to provide mechanical means of unloading and conveying coal, in order to safeguard the coal supply, as well as to reduce the cost of handling, and recommended that, as it appeared to be in the interests of the Council that Poplar should provide a stand-by for Stepney until 1917, as proposed, the "heads of agreement" should be approved of by the Council. At the meeting of the Council on Thursday last week, these recommendations were agreed to.

Fulham.—A new coal bunker, to store an additional 1,000 tons of coal at the electricity works, is to be constructed.

Maidenhead.—The T.C. has arranged to give a supply of power to the premises of Messrs. Cox Bros. & Co., Baltic Wharf. It is proposed to intall another Diesel engine at the electricity works, owing to the economies resulting from the use of the one already installed.

The E.L. Committee has reduced the charge for public lighting for the 38 main arc lamps to £14 10s. each per annum. This, with a previous concession, will reduce the public lighting charges by £200 per annum.

Retford.—Once more the T.C. has taken up the subject of obtaining a public electricity supply. At a meeting on Friday last, the Mayor moved that a committee be formed to consider and report. Councillor Hollely seconded, commenting on the development of coalfields nearer Retford. Councillor Moss opposed the proposition, and referred to the obtaining of a prov. order in 1899, but nothing was done, and it was revoked. The subject had been discussed in 1904 and later. Mr. Mountain, of Huddersfield, prepared a lucid report, and both the Traders' Association and the Council decided that it would be a non-paying concern at Retford. No private company would undertake the risk. The Mayor's proposition was, however, carried by 17 votes to 2, and a committee appointed.

Rotherham.—The T.C. has received the sanction of the L.G.B. to a loan of £14,780 for cables, and £6,287 for machinery.

Southborough.—The U.D.C. has decided to ascertain the cost of obtaining a prov. order for E.L. At present the only public illuminant is gas.

Stockton Heath.—The P.C. has decided to take steps to ascertain the wishes of the ratepayers respecting a supply of electricity for the parish. The promoters of the scheme are prepared to give a supply if there is a reasonable demand for current.

Swaledale.—The electric light has been introduced into Swaledale, the supply being by means of overhead wires.

Taunton.—After a prolonged trial of electricity as a motive power, the Somerset Manufacturing Co. has recently completely equipped its plant with electric motors. The whole of its South Street factory is now being driven by 14 electric motors of a total of 84 H.P., taking current from the Corporation mains, and the electric drive is giving entire satisfaction.

Wakefield.—The L.G.B. has sanctioned the borrowing by the Corporation of £4,500 for mains, £540 for transformers, and £500 for sub-stations.

Walthamstow.—The Council has decided to undertake the work of maintenance and repair of the electric light installations at the various schools, at the actual cost of the same plus 5 per cent. for establishment charges. Sanction has been received from the L.G.B. to the borrowing of £5,374 for the Blackhorse Lane feeder cable and spare stoneware conduit from Church Hill to Fulbourne Road, and £1,260 for the feeder cable from Barrett Road to Fulbourne Road.

Worthing.—The electricity undertaking came in for a good deal of criticism at the meeting of the T.C. on Monday, the two chief sources of complaint being the repeated failure of some of the arc lamps in the streets and the emission of black smoke from the chimney shaft at the generating station. With reference to the first of these grievances, the Electricity Committee submitted a report from the resident engineer, in which the latter explained that great difficulty had been experienced with the cable during the past summer, more particularly during the months of July and August. Ultimately the cause was traced to the expansion of the cables which took place owing to the abnormally high temperatures in the pits and conduits. As an instance, the engineer pointed to a concentric feeder where the cable was observed to "grow" to the extent of ½ in. in a one day observation. In cases where a bend in a cable at a street corner permitted the "growth" to be taken up by natural movement, the expansion had no ill effects (except in two instances where the insulation of the bends broke down), but in long straight lengths trouble frequently occurred in joint boxes, and small arc lamp cables also suffered through the cracking of the insulation. With reference to the complaint as to the smoke from the chimney at the generating station, the chairman of the Committee explained they were now accepting a tender for smokeless coal which would remedy the complaint. Commenting on the complaints as to the unsatisfactory lighting of the streets by electricity, Councillor Tree observed that it was a question whether they were getting the best value out of their electricity, and whether they ought not to revert to gas, but Councillor Gardner quoted some figures which showed conclusively that the town was getting good value for its money in the matter of its public lighting by electricity. The average candle-power of the electric arc lamps in the borough (not including the smaller bracket lamps) was 124,000, and the amount charged by the Electricity Committee for public lighting during the past year had been £3,116. The average candle-power of the gas lamps in use for public lighting (based on an average of 90 C.P. for an incandescent lamp) totalled to 64,300, and the cost of the lighting had been £1,925. Alderman White also pointed out that the time was approaching when the repayments on borrowings would be much smaller, and that this would be reflected almost at once on the cost of public lighting by electricity.

TRAMWAY and RAILWAY NOTES.

Accrington.—Mr. E. Woolley (Accrington) has reported to the Assessment Committee of the Haslingden Board of Guardians that he and the clerk, representing the Assessment Committee, and Mr. Higham and Mr. Beckett, borough accountant, representing the Accrington Corporation, had met and discussed with Mr. T. Wainwright, of Liverpool, the award of the latter in the recent arbitration regarding the assessment of the Accrington tramways. The union valuer had assessed the tramways at £1,650. Accrington contended that the figure should be £650. The arbitrafor awarded £2,549 (rateable value). Accrington sought to reopen the question on the ground that the umpire had not given the basis of his finding. The umpire at the conference referred, to gave the reasons that led him to adopt the principles of his award, and also supplied a copy of his valuation which confirmed the award.

A special Committee appointed by the T.C. has presented a report in which it expresses the opinion that "considerable economies can be effected in the tramway department, partly by a

rearrangement and reduction of the staff, and partly by an adjustment of the work and duties and work of other members of the staff." No arbitrary dismissals are recommended, the Council to take these matters into consideration when the opportunity presents itself, and those officials whose positions are done away with are to be given full notice and amply compensated. Previously, the department has been worked under four heads—traffic, overhead equipment, permanent way and car maintenance and repair. The suggestion is to group two or more of these departments. The old manager, Mr. Wilson, has agreed to retire on £200, wages for one year in lieu of notice, and £50 per year for the next four years, his services to be retained as a consulting manager. The new manager, Mr. H. Pilling, has been promoted from the ranks, and he will receive a salary of £200 per year. Mr. Pilling, the Committee point out, is a member of the Institution of Electrical Engineers. The Committee is hoping to save at least £15 per week by contemplated changes.

Ardsley.—The U.D.C. has decided to object to and oppose the proposal of the Wakefield and District Light Railway Co. to abandon the tramway to the town.

Barrow.—At the T.C. meeting on Monday, reference was made to the new electric car service on Walney Island. Alderman Smith pointed out that the amount of patronage for the winter was problematical, and in order to prevent cars running empty there would be a curtailed service. If a person wanted to journey to Biggar Bank at a time when the ordinary car was not running over the line, he could by paying an extra 6d. have a car run for his use.

Brighouse.—A Sub-Committee has been appointed to inquire into the cost of providing a tramway by the Council from the centre of the borough to the top of Rastrick (to be leased to another authority, or to be worked by the Corporation), and also to ascertain the cost of introducing and maintaining a system of railless trolley vehicles. It was stated that the powers authorising the West Yorkshire Tramways Co. to construct the tramway expired on August 4th last.

Dundee.—Plans of the railless trolley system on Clepington Road, for which the Corporation is asking the approval of the B. of T., are now open for inspection at the tramway office.

Glasgow.—The T.C. is now becoming quite familiar with the records established by the drawings of the tramway undertaking. Several times this year the previous best income has been eclipsed, and last week brought with it yet another record. The takings for the seven days ending Saturday night amounted to £21,008. This was attributed to the spring holiday, the large number of football matches on that and on other days and the fine weather. The previous record—£20,953—was for a week in May at the opening of the Exhibition. Saturday's drawings reached £4,332.

Gloucester.—The minutes of the Light Railway Committee for a period of nine weeks, from July 20th to September 20th, show that during that time the cars ran 3,533 more miles, and carried 53,931 more passengers; the receipts were £190 more; £114 less was paid for current, and £55 more in wages as compared with 1910. There was, therefore, a net gain in revenue of £249. This was mainly brought about by the use of car meters.

London.—Application is being made to the City Corporation by the L.C.C. for consent to the introduction of Bills in Parliament authorising the construction of a tramway in Bishopsgate Street as far as Middlesex Street, and another from Charles Street to a point north of Ludgate Circus *via* Farringdon Road and Farringdon Street.

Nottingham.—An agitation which threatened to dislocate the tramway service has been averted by the Corporation making concessions, the principal of which are the reduction of the hours of motormen and conductors from 62 to 56 per week of six days, and a small increase of pay.

Preston.—Councillor Crompton, chairman of the Tramways Committee, speaking at a recent Council meeting, dealt with the requests for concessions by employés, and the Committee's reply thereto. He read a letter from Mr. C. T. Jackson, general secretary of tramwaymen, from which he said it was clear the threat on the part of the local tramwaymen to strike on the eve of the Preston holidays, unless certain demands were conceded within 24 hours, not only had not the approval of the men's leaders at headquarters, but the latter regretted the position the Preston branch had taken up. Councillor Crompton asserted that 75 per cent. of the men were perfectly satisfied with their conditions of labour and their wages. The Committee, in the matter of control, were determined to brook no outside interference.

Rotherham.—The T.C. has decided to proceed at once with the construction of the railless trolley route to Maltby, and to extend the tramways from Dalton to Thrybergh, and from Broom to the borough boundary.

Twickenham.—The representatives appointed by the Council to attend the conference at Hounslow *re* intercommunication between Southall and Twickenham *via* Hounslow, report that as all other means to connect those districts had failed, the Heston and Isleworth U.D.C. had determined to include in its General Powers Bill intended to be promoted this session, power to provide and equip a system of railless trolley vehicles.

West Hartlepool.—At a meeting of the T.C. on September 29th, a special report of the Committee appointed to deal with the tramways was considered. The report stated that the company had practically ignored the suggestions of the Council as to leasing the purchased lines, and had put forward offers previously made to the T.C. and rejected by it. A further letter had since been received from the company in reply to a letter from the town clerk stating that the company had no desire to lease the lines. A report from Mr. Hamilton had been received, from which the Committee formed the opinion that a sound and acceptable scheme for the operation of the tramways by the Corporation was practicable. The Committee recommended: That notice be served on the promoters for the purchase of the lines to Hartlepool; that all necessary powers for working all lines purchased, and for the construction of such additional lengths of line as were recommended by Mr. Hamilton, be applied for by provisional order; that the selection of routes for additional lines be left to a sub-committee; that the electrical arrangements connected with the running of the cars be referred to the Electricity Committee. Mr. Patterson moved the adoption of the report, which was seconded by Mr. Charlton. Mr. Martin moved an amendment that the T.C. enter into negotiation with the Tramway Co. on the basis of the suggested agreement of October last. He said if they accepted the Committee's recommendations they would be committing the town to an expenditure of from £100,000 to £120,000. The tramways in that town would never pay. They had been losing something like £5,000 every year. After further discussion the amendment was negatived, and the report was adopted.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Amalgamation.—The extraordinary general meetings of the Anglo-American and Direct United States Companies, which are reported elsewhere in our issue to-day, passed, after some discussion, the resolutions submitted. These have now to be confirmed by a second general meeting 14 days later, and the Court's consent must be obtained afterwards to the alteration of the memorandum. This will be the final act in handing over the above Companies' cables to the Western Union Co.'s management.

Denmark.—On October 1st the rate for telegrams to Denmark was reduced to 2½d. per word, with a minimum charge of 10d. per telegram.

Germany.—Last year Dr. Dieckmann was commissioned by the Bavarian Government to make the experiment of erecting a wireless station on the Zugspitze, the highest mountain top in Germany, near the Bavarian and Tyrol frontiers, and in a short time the station will be ready for working. Instead of erecting the antennæ on the summit, which stands at 2,964 m. above sea-level, and which was inadvisable on account of the violent wind storms which there prevail, they were fixed below on the rock-face without prejudicial result. Across the border, in Austria, the erection of an observatory in the Erwald has been projected, and it is now decided to equip it with a wireless plant with a view to connection with the Zugspitze station.

Russia.—A Government Bill has been introduced to authorise the complete reorganisation of the telephonic service, under the control of the State.

The Aerophone.—It is reported that Mr. H. Grindell-Matthews, who was to have given a demonstration of his wireless telephone system before representatives of the War Office and the Admiralty on Friday last, abruptly withdrew his apparatus from the War Office, alleging that several Government officials tampered with the apparatus and made sketches of it during his temporary absence. There is to be an official investigation into the charges, which are absolutely denied by the War Office, the latter alleging that the experiment was a failure for some reason not explained.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—The electrical engineer having reported on the extension works, it has been decided to obtain tenders for the installation of a generating plant, and further switchgear in connection with the high-tension supply at Globe Works.

Australia.—Western Australia.—November 21st. One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

Queensland.—November 8th. Deputy P.M.G. Switchboards, measuring instruments and protectors, telegraph instruments, switchboard parts and accessories, telephone instruments. High Commissioner in London, 72, Victoria Street, S.W.

South Australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" September 22nd.

New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" September 22nd.

South Australia.—November 15th. Deputy P.M.G. Seven magneto switchboards, three milammeters, six relays and one set of Wheatstone fast-speed duplex repeaters, 10 tons of hard-drawn copper wire, and one electro-motor.

November 15th.—Telephone cords and ear-pieces, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 15th.—Magneto switchboards, &c., for the P.M.G. See "Official Notices" to-day.

Queensland.—November 8th. Ironwork, measuring instruments and protectors, switchboards, switchboard parts and accessories, telegraph and telephone instruments, for the P.M.G.'s Department. See "Official Notices" September 29th.

November 22nd.—Cable for the P.M.G.'s Department. See "Official Notices" September 29th.

Victoria.—November 28th. Ebonite earpieces calculagraphs, and insulators for P.M.G. See "Official Notices" to-day.

Belfast.—October 9th. 2,000-ampere switchboard apparatus, and field regulating rheostat and change-over switch, for the Corporation. See "Official Notices" September 29th.

Blackley.—October 10th. Extensions and alterations to electric bell and telephone installation, Booth Hall Infirmary, for Prestwich B.G. E. W. Ogden, clerk, Cheetham Hill Road, Manchester

Bulgaria.—Tenders are invited by the municipal authorities of Plevna for the installation of an electric lighting system in that town. Estimated cost £20,000. Tenders received up to November 4th/17th. Only firms which have previously carried out similar contracts successfully will be allowed to compete. Deposit £1,000. Copies of the plans and specifications may be obtained from the Plevna Municipality on payment of 25 fr. (£1).

Dunedin.—November 1st. The Corporation is inviting tenders for one 800-kw. gas-driven generating set. Specifications can be seen at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, London, E.C.

France.—October 14th. The municipal authorities of Lyons are inviting tenders for the contract for an installation of electric lighting in the Lyons Municipal Library.

Glasgow.—The Clyde Navigation Trustees invite tenders for a 32-ton electric crane for the east end of Rothesay Dock.

Great Western Railway.—October 16th and November 7th. Stores for a year. See "Official Notices" to-day.

Grimsby.—October 16th. Paper-insulated lead-covered cables, house fuse boxes, and mains service boxes for the Corporation. See "Official Notices" September 29th.

Hastings.—October 18th. Electric lighting of the workhouse, Ore, for the B.G. See "Official Notices" September 15th.

South Africa.—November 22nd. Posts and Telegraph Department. Tenders for power-generating plant, consisting of motor-generator, accumulators, switchboard, &c. Forms of tender and specifications from either District Stores Clerk, G.P.O., Johannesburg, or Controller of Stores, G.P.O., Capetown.

London.—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

Hackney.—October 12th. 100,000 pairs of white open type arc lamp carbons, for the B.C. See "Official Notices" September 22nd.

Hammersmith.—October 11th. A.C. and D.C. motors for the Council. See "Official Notices" to-day.

Perth.—October 14th. The T.C. invites tenders for overhead coal storage hoppers, conveyors, capstans, and electric generating plant for stoking machinery, also alteration and extension of existing coal elevator and hoist. W. B. McLusky, gas engineer.

Russia.—The municipal authorities of Archangel are at present inviting tenders for the concession for the construction and working of an electric tramway in the town.

Siam.—December 30th. Tenders are invited for five electrically-driven centrifugal pumps for the waterworks at Bangkok. Particulars, Local Sanitary Department, Bangkok.

Spain.—The municipal authorities of La Oliva de Menda (province of Badajoz) have recently invited tenders for the concession for the electric lighting of the town during a period of six years.

October 16th.—Tenders are invited for the supply of a transformer, underground cables and accessories for three cranes for the harbour of St. Lucia Janta de Obras del Puerto, Corunna.

Taunton.—200-k.v.a. single-phase alternator, superheater, cables, and induced draught fans for the Council. See "Official Notices" to-day.

CLOSED.

Belgium.—Six firms, including the British Insulated and Helsby Cables, Ltd., competed for the contract for the supply of the bronze overhead trolley wire required by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, during the year ending September 30th, 1912, the lowest offer being that of the Compagnie Française des Métaux, of Paris. The lowest bid for the contract for the supply of the electric rail connections during the same period was that of Messrs. Felten & Guilleaume.

No fewer than 13 concerns—eight German, two British (Henley's Telegraph Works and the British Insulated and Helsby Cables, Ltd.), and one each Belgian, French and Austrian—tendered for the supply of a quantity of cable to the Belgian Post and Telegraph authorities in Brussels, the lowest being that of the Ateliers de Constructions Electriques de Charleroi.

Burnley.—The Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for a supply of cables.

Eccles.—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., at £709, for a H.T. single-phase A.C. switchboard for the electricity works.

Gloucester.—The Governors of the Royal Infirmary have placed an order with Messrs. Parsons Bros., of Gloucester, for a 20-line intercommunication telephone installation on the Parsons-Sloper system. The wires are to be run in conduit throughout.

Haslingden.—In connection with the electricity scheme the following tenders have been accepted :—

Ferranti, Ltd.—Switchboard and accessories.
British Westinghouse Co., Ltd.—Static transformers.

London.—Poplar.—The B.C. Electricity Committee has received the following tenders for the supply of one 3,000-kw. turbine alternator and condenser :—

Richardsons, Westgarth.—Alternator by General Electric Co., £7,532; ditto, British Westinghouse Co., £7,692; ditto, Bruce Peebles & Co., £7,892; ditto, Siemens Bros., £7,993, alternative £9,735; ditto, Vickers, Ltd., £8,072.
Willans & Robinson.—Alternator by General Electric Co., £7,581, alternative £7,543; ditto, Bruce Peebles & Co., £7,797, alternative £7,759; ditto, Dick, Kerr & Co., £7,842, alternative £7,804; ditto, Siemens Bros., £7,970, first alternative £7,936, second alternative £8,391, third alternative £8,348; ditto, Vickers, Ltd., £8,063, alternative £8,025; ditto, Electric Construction Co., £8,364, alternative £8,326.
Dick, Kerr & Co.—Condenser by Mirrlees, Watson & Co., £7,617, alternative £7,967; ditto, W. H. Allen, Sons & Co., £7,652.
C. A. Parsons & Co.—Alternator by British Westinghouse, £8,306, first alternative £8,402, second alternative £8,012; ditto, Bruce Peebles, £8,357, first alternative £8,453, second alternative £8,063; ditto, Siemens Bros., (a) £8,457, first alternative £8,553, second alternative £8,163; (b) £8,567, first alternative £8,663, second alternative £8,273; ditto, Dick, Kerr & Co., £8,465, first alternative £8,561, second alternative £8,171; ditto, Vickers, Ltd., £8,608, first alternative £8,704; second alternative £8,314; ditto, Parsons, £8,882, first alternative £8,928, second alternative £8,538.
Belliss & Morcom.—Alternator by General Electric Co., £8,456; ditto, Bruce Peebles & Co., £8,860; ditto, Siemens Bros., £8,877.
Brush Electrical Engineering Co.—£8,727, alternative £8,460.
British Westinghouse Co.—£8,776, alternative £9,269.
James Howden & Co.—Alternator by British Westinghouse, condenser by Mirrlees, Watson & Co., £8,970, first alternative £8,865, second alternative £9,019; alternator by Bruce Peebles, condenser by Mirrlees, Watson & Co., £9,145, first alternative £9,040, second alternative £9,194; alternator by Siemens Bros., condenser by Mirrlees, Watson and Co., £9,279, first alternative £9,174, second alternative £9,328; alternator by Vickers, Ltd., condenser by Mirrlees, Watson & Co., £9,389, first alternative £9,284, second alternative £9,338.
Musgrave & Sons.—Alternator by General Electric Co., £9,267.
Fraser & Chalmers.—Alternator by General Electric Co., condenser by Mirrlees, Watson & Co., £9,925, first alternative £9,785, second alternative £10,023, (Allen's condenser) third alternative £9,473; alternator by Siemens Bros., condenser by Mirrlees, Watson & Co., £10,276, first alternative £10,136, second alternative £10,373, (Allen's condenser) third alternative £9,824; alternator by Vickers, Ltd., £10,418, first alternative £10,278, second alternative £10,516, (Allen's condenser) third alternative £9,966; alternator by General Electric Co., condenser by Worthington Pump Co., first alternative £10,112, second alternative £9,773 (Allen's condenser); alternator by Siemens Bros., condenser by Worthington Pump Co., first alternative £10,463, second alternative £10,124 (Allen's condenser); alternator by Vickers, Ltd., condenser by Worthington Pump Co., first alternative £10,605, second alternative £10,266 (Allen's condenser).
British Thomson-Houston.—Condenser by Mirrlees, Watson & Co., £9,854, first alternative £9,728.
J. Musgrave & Sons.—Alternator by Siemens Bros., £9,911, first alternative £10,011.
J. Storey & Son.—Condenser only, £3,195.
Cole, Marchant & Morley.—Condenser only, £2,865, first alternative £2,695.
Mirrlees, Watson & Co.—Condenser only, £3,200.
Worthington Pump Co.—Condenser only, £3,180, first alternative £2,830.
W. H. Allen, Sons & Co.—Condenser only, £3,069, first alternative £2,594.

After carefully considering the various types of plant offered and having regard to the cost, reliability and efficiency, the engineer states that the lowest tender received for the complete plant, comprising turbo-alternator and condenser, is that of Messrs. Richardsons, Westgarth & Co., viz., £7,532. The turbine is of the combined impulse and reaction type, coupled to a General Electric alternator, with Contraflo condenser of 7,100 sq. ft. cooling surface, fitted with kinetic air pump. The cooling surface of the condenser was smaller than he would recommend, and the kinetic air pump was of a type of which little experience has been gained in this country, and one which he was not prepared to recommend. The second tender, in order of price, was that of Messrs. Willans and Robinson, viz., £7,581, with Edwards pump and a Willans condenser, with a cooling surface of 10,000 sq. ft. The turbine was of the combined impulse and reaction type, coupled to a General Electric alternator. The condenser was of a size that recommended itself, being nearly 50 per cent. larger than that of Messrs. Richardsons & Westgarth. He was thoroughly satisfied with the work of Messrs. Willans & Robinson, and, next to Messrs. C. A.

Parsons & Co., they had probably had more experience in turbine building than any other makers in this country. The most effective turbine put forward was the two-cylinder pure reaction type of Messrs. C. A. Parsons & Co., which had a guaranteed average steam consumption at ¾, full, and overload of 13·17 lb. Coupled to a British Westinghouse alternator, and with Parsons condenser and Edwards air pump, the amount of this tender was £8,902. The condenser had a cooling area of 5,340 sq. ft. only. This type of turbine occupied the largest floor space, and was necessarily most costly in regard to foundations. If installed at the Council's works, both of the existing converters would have to be dismantled, and re-erected in another position. The engineer was satisfied that this type was a great improvement upon those now installed, but he was not convinced that the guaranteed steam consumption would be steadily maintained. If trouble were experienced, as in the past, the value of the initial low consumption would be materially discounted. The cooling surface of the condenser put forward was very small for the special conditions of the circulating water, and if the turbine should be considered the most satisfactory, he would recommend the substitution of an Allen's condenser of 10,600 sq. ft. capacity, at an additional cost of £663. Compared with the tender of Willans & Robinson, the following result was obtained :—

Willans net tender, £7,581 ; add estimated capital value of difference in guaranteed consumption, £2,058 ; total, £9,639.
Parsons net tender, £8,902 ; add for substitution of condenser £668, estimated extra cost of foundations and removal of converters, say, £300 ; total, £9,865.

Therefore, the ultimate cost of Parsons's plant would be greater, and would, moreover, involve an immediate expenditure of £2,284 more than that of Willans, whilst the gain from improved efficiency was entirely dependent upon the reliability of the plant. Having regard to the foregoing report of the engineer upon the tenders received, the Committee has decided to accept the tender of Willans & Robinson, for the supply, delivery and erection of a 3,000-KW. steam turbine, coupled to a three-phase alternator, with the necessary condensing plant, at £7,581. The following tenders have been received for the provision of one overhead bunker, and one combined coal elevator and conveyor :—

Tickle Bros.—(*a*) Bunker, £1,076 ; (*b*) new conveyor, £190.
New Conveyor Co.—(*a*) £1,188 ; (*b*) £609.
Bennis & Co.—(*a*) £1,270 ; (*b*) £610.
Spencer.—(*a*) £1,212 ; (*b*) £865.
Edgar Allen & Co.—(*a*) £1,730 ; (*b*) £818.
Barry, Hendry & Co.—(*a*) £2,050 ; (*b*) £475.
Babcock & Wilcox.—(*a*) £2,100 ; (*b*) £760.
Dempster & Sons.—(*a*) £1,654 ; (*b*) £1,015.

The specification in the case of the lowest tender, the committee reports, was incomplete, and no drawings were submitted. It was accordingly decided to accept the next lowest tender, that of the New Conveyor Co., for supply, delivery and erection of one overhead bunker and one combined coal elevator and conveyor, at £1,797.

FULHAM.—The Electricity Committee has divided the contracts for 5,000 tons of coal as follows, the total cost being £2,583 :—

Hinchliffe & Co.—1,000 tons at 8s. 6d., 500 tons at 11s. 5d.
Harrison & Tidswell.—1,500 tons at 9s. 11½d.
Gilman & Co.—2,000 tons at 11s. 5d.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co. for coal for the electricity works for a year, at £1 0s. 4d. per ton, for the best large Crynant.

Manchester.—The orders for the complete installation of electric light, and experimental work, including all switch-boards, plug-boards, &c., at the new Physical Laboratories, and for the complete installation of electric light for the new Botanical Laboratories, have been placed with Messrs. Sewell & Varley, of Manchester.

Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for three transformers.

Settle.—On the Hospital Lighting Committee's recommendation, the B. of G. has accepted the tender of Messrs. Garsden and Co., of Manchester, at £213, for an electric lighting installation.

Teesside.—Messrs. Stothert & Pitt, Ltd., of Bath, have obtained a contract for the supply of five 5-ton electric cranes for use on extensive quays on the Teesside.

Wakefield.—The tender of Newhall's Insulation Co., Manchester, at £105, for lagging steam-pipes at the electricity works, has been accepted.

Warrington.—The T.C. has accepted the tender of Mr. George Wallington for the construction of the foundations for an induced-draught plant at the electricity works. The Council has recommended the Education Committee to obtain fresh tenders for the work of installing electric light at the Evelyn Street School.

Worthing.—The T.C. has ordered 750 tons of Dynevor Duffryn smokeless steam coal, at 19s. 8d. per ton, from the Main Colliery Co., Ltd.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, October 7th. Visit to the Marconi Wireless Telegraph Co.'s Works, Chelmsford. Train from Liverpool Street, 1.55 p.m.
Wednesday, October 11th. At 8 p.m. At St. Bride's Institute, E.C. Presidential address by Mr. W. H. Maw.

Institution of Mechanical Engineers (Graduates' Association).—Monday, October 9th. At 8 p.m. Paper on "The Advantages of the Steam Turbine as Compared with the Reciprocating Engine," by Mr. W. A. Hatch.

Leeds University Engineering Society.—Monday, October 9th. Paper on "Radium and Energy," by Prof. W. H. Bragg.

British Electrical and Allied Manufacturers' Association (Inc.).—Thursday, October 12th. At 2.30 p.m. Council meeting in the Board Room, Olympia, Kensington, W.

Junior Institution of Engineers.—Friday, October 13th. At 6.30 p.m. Visit to "The Model Engineer" Exhibition at the Royal Horticultural Hall, Westminster.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

THE following orders are issued :—

Drills for efficiency (1911-1912) will commence at Headquarters on Thursday, November 2nd, 1911, and Headquarters will be open as stated below from that date :—

Daily (except Saturdays), 10 a.m. to 10 p.m.
Saturdays (unless otherwise ordered), 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

To Exhibition Visitors.—Central station engineers, electrical committees, deputations and others intending to visit the Exhibition are asked to advise the management at Olympia as to the dates of their proposed visits.

The Electrical Contractors' Association and Sheffield Corporation.—According to the *Standard*, the long-anticipated action by the above Association against the Sheffield Corporation, in respect of the municipal electric wiring business in Sheffield, will come on for hearing before Mr. Justice Eve early in the next sittings of the Law Courts, which begin on October 12th. The action will be by the Attorney-General, at the instance of a Sheffield ratepayer, for whom Mr. P. O. Lawrence, K.C., and Mr. Maurice Drucquer will appear, while Mr. Danckwerts, K.C., and Mr. J. Serjeant will appear for the Sheffield Corporation. It is improbable that there will be much evidence, as the existence of a municipal wiring department at Sheffield is an admitted fact. Consequently, the action will take the form of arguments, which in effect will be an appeal against the judgment of Mr. Justice Neville in the Leicester case. This held that it was illegal for a municipality to carry out wiring work except under special Parliamentary powers. The Leicester Corporation accepted this judgment as final, and closed down its wiring department. The position at Sheffield is interesting, however, from the fact that the Corporation in 1898 acquired the undertaking of the Sheffield Electric Light and Power Co., and £6,000 of the purchase-money was paid specifically in respect of the house wiring department. When the undertaking was taken over by the Corporation the local contractors asked that this department be discontinued, but the Corporation resisted their demand, and has continued the wiring of consumers' premises ever since. It is said to be the intention of the Sheffield Corporation, in the event of its losing the action, to continue the case to the Appeal Court, and, if necessary, to the House of Lords.

Local Government Board and Fair Wages Clause.—The Local Government Board has issued a circular letter to local authorities embodying the resolution passed by the House of Commons on the subject of fair wages clauses in contracts, and the recommendations made by the Advisory Committee of representatives of Government Departments, which has been established. The letter points out that the Advisory Committee recommends that clauses such as those inserted in Government contracts should also be introduced into contracts which are not entered into by Government Departments, but which involve the expenditure of public money, or other consideration granted by a Government Department, or which require the approval of the department. It appeared to the Board that the policy adopted in the case of Government contracts should be followed in the cases of all contracts for the execution of works, or the supply of materials, which are entered into by local authorities, or by, or on behalf of, any Committee, wholly or in part appointed by a local authority. Whilst they were aware that many local authorities specified in their contracts conditions to be observed by the contractor as to the rate of wages and other matters affecting persons employed by him, the Board thought that in every case the authority should give the matter careful consideration with the view to the introduction in all contracts of clauses on the lines of those inserted in Government contracts.

(*Continued on page* 573.)

SUPPLEMENT.

Olympia and After.

That the present Exhibition will be of great educative value to those who attend it, is unquestionable, but its actual influence on the electrical industry in the immediate future must depend to a great extent upon the manner in which its message to the public is followed up by the contractor, using the term in its widest sense, to cover all those who in private business or municipal employ are engaged in providing the public with the means of applying electrical energy to its needs. It is a characteristic of our profession that few engaged in it escape the fascination of its rapid growth and constant change. Fed by a vigorous science, and trained by keen competition, it offers scope for energy and satisfies the needs of the imagination; in the confidence and almost partisan enthusiasm of its followers, lies much of its strength and some weakness. The man who is daily absorbed in electrical work often fails to realise that to the public electricity supply is one of the many conveniences offered by modern life, and one for which there are often several substitutes; its importance to the individual may be quite secondary, its extensive use only representing a small portion of his cost of living, and consequently its economics offering but little scope for overall gain, whilst entailing immediate outlay, and, perhaps, changes in business, or in the even more conservative methods of domestic life, which have served, if not perfectly at least unquestioned, for a long time. These reflections need not discourage, but should rather help by suggesting the need for study of the mental attitude of potential buyers, and perhaps also that price cutting is not the only, or even the best, way of obtaining business in a commodity of permanent utility. Patient and very persistent educative work, not of a strident or wholesale character, but informed by technical ability and directed to individual needs, will prove the most efficacious, and provide examples of successful use, than which there is no more powerful form of advertisement.

Satisfactory Progress.

While, no doubt, it must be admitted that the Executive Committee is not omniscient or omnipotent, and that some things might have been done better, we cannot agree with one of our electrical contemporaries that it has "completely failed" in its endeavours to bring the public to the show, or that "there have been no lay Press advertisements." Agreeing, with regret, that the lay Press usually cares nothing about engineering in comparison with the superior attractions of sensational law cases, hobble skirts and such like futilities, unless its attention is enchained by substantial "compensations," we must point out that the Exhibition has been advertised every day in 25 newspapers, and that the lay Press has been remarkably generous in publishing special articles on the exhibits at Olympia. As a matter of fact, the receipts at the paying gates have been quite up to the anticipations of the Executive, which proves that the latter has not failed in its duty. The admissions at the ticket gate have been less satisfactory, mainly because the tickets have not been distributed as early as they should have been; but enormous numbers of tickets have been purchased by the exhibitors (though not by the supply authorities), and these are bound to produce their effect during the rest of the run of the Exhibition. The proposal which was mooted, that the technical Press should prepare articles of a popular nature for insertion in the daily papers, fortunately died of inanition before it matured to the stage at which it would have been contemptuously rejected by the editors of those papers, to whom the technical Press is nothing but a name, and over whose judgment the technical Press can exercise not a jot of influence. The fact that the idea for a moment found supporters merely indicates a total lack of comprehension of the relations existing between the lay and the technical Press.

The only way in which publicity in the columns of the daily papers can be ensured is the sordid method upon which we have already commented in another connection. It appears to be impossible for the Executive to embark upon a costly scheme of advertisement on a lavish scale, but much can be effected by the collective efforts of exhibitors, and it is to them that we must look to take the necessary steps.

The impression under which some exhibitors, or those who pose as voicing their views, are labouring—that the Exhibition cannot be a success unless its floor is crowded with non-technical visitors—is valid only to a limited extent. It is true that we wish to see a great attendance; but some at least of the exhibitors are more concerned that the visitors, though moderate in number, shall be of the right class. Many of the exhibits appeal solely to technical men, and the owners of such care nothing for bands or spectacular effects, or other popular attractions. Their interests are best served by notices of the exhibits published in the technical Press, which meet the eye of the class of reader referred to. We are glad to add that numerous orders have been placed by these visitors, and the amount of business done seems to have given general satisfaction. The daily Press, on the other hand, caters for the consumer and the class from which prospective consumers are drawn, and, therefore, would best contribute to the success of the Exhibition by drawing attention to the unique display of lighting, cooking and heating apparatus which has been concentrated at Olympia. We believe that electric cooking in particular will derive an immense impetus from this Exhibition; demonstrations of the greatest interest are given daily in various parts of the building, and the excellent results obtained cannot fail to carry conviction to the minds of the spectators. As Mr. Mordey truly said at the inaugural dinner, in these matters the ladies are the paramount authorities, and it is to them that the arguments and demonstrations must be addressed. That the object is in some cases, at any rate, attained we have certain knowledge.

Evening Lectures at Olympia.

In the Pavilion of the London Electric Supply Companies lectures of a popular character, and with suitable demonstrations, are being delivered by Mr. R. Borlase Matthews, and by arrangement with the General Electric Co., Ltd. The first of the series took place on September 28th, at 8 p.m., the subject being "Electric Cooking and Power in the Home"; an hour later this was followed by one on the "Comforts of Electric Lighting and Heating." Yesterday, October 5th, the same order was to be followed, and the lectures are to be repeated on October 12th and 19th. The Saturday lectures in the series are arranged for to-morrow, October 7th, and October 14th and 21st, lighting and heating being the subjects of the 8 o'clock lectures, and cooking and power those at 9 p.m.

H

THE EVOLUTION OF WIRING SYSTEMS.

BY J. W. B.

THE technique of installation work in this country is at present in a somewhat unstable condition. For many years wood-cased work and steel conduit have been regarded as standard practice, the latter having become highly developed in detail in the attempt of designers to provide fittings for every likely requirement, and to eliminate so far as possible dependence upon the skill of the user. In its most complete form the metal conduit system will possibly remain the most generally satisfactory where the importance of the installation will allow of comparatively high cost and adequate inspection. Wood casing is at the present time much less used than it deserves to be, to some extent because the wireman-carpenter has almost disappeared in consequence of the general use of tube systems. There can be little doubt, however, that for interior work wood casing offers less risk than imperfect and partially earthed tube systems, and poor workmanship is less likely to lead to trouble on cased wiring than on any metal-sheathed system.

It may be urged against either of the above systems that they deprive electric wiring of much of the flexibility and adaptability to changing conditions which it should naturally possess.

During recent years the impetus which electricity supply has received from improvements in lamps and the general fall in tariffs has made possible a great increase in business with the smaller users of light, to whom the first cost of equipment is always an important consideration, and may be the only bar to the adoption of the supply. To meet these changed conditions engineers and manufacturers have brought forward new systems of wiring, and revived old ones with considerable energy. The result is that quite a number of alternative methods are now offered to the wiring contractor. The systems in question are primarily designed to reduce cost. The extent to which they do so in practice is, however, modified by various circumstances to an extent not always realised by their designers. For example, the causes which have led to their inception have also led to the simplification of lighting fittings. To-day a fuller recognition of the principles of scientific illumination, and a tardy escape from the traditions of the gas and oil lamp, have led to the almost entire abandonment of the elaborate metal and glasswork which formed a part of even simple installations, and, incidentally, carried the bulk of the contractor's profit. In consequence it is now necessary for him to secure a higher percentage of profit on the wiring, which deprives the buyer of some of the advantages of the cheaper systems.

Similarly the cost of labour is not found to fall rapidly with the introductions of simpler methods, owing to the fact that a certain familiarity with the new material has to be gained by men who, in most cases, owing to lack of workshop training, are not readily adaptable to changes, and who, furthermore, look with some distrust upon any device having for its object to make the result of their labour cheaper to the consumer of it. It must also be borne in mind that with wiring, as with all work carried out on a consumer's premises, the time lost in preparation and changing jobs is an important item, and becomes more so as the individual jobs become shorter.

There is no doubt, however, that both on technical and commercial grounds new wiring methods are worthy of extended trial by contractors who desire to share the extensive business in fitting small property which may be expected in the near future.

As an example of the influence of different systems on cost, the following figures may be taken as representative for small private house work :—

INSTALLATION COMPLETE WITH TUNGSTEN LAMPS AND CORD PENDANTS.

No.	System.	Cost per lamp.
1.	Screwed seamless conduit	22s.
2.	Brazed ditto. with good continuity fittings ...	21s.
3.	Close-joint slip conduit	18s.
4.	Wood casing	17s.
5.	Stannos wiring (concentric)	13s.
6.	Lead-covered twin V.I.R. insulated wire ...	13s.
7.	Rubber and cotton-covered flexible on button insulators	12s.
8.	V.I.R. cable and porcelain cleat insulators (600 meg. non-association wires). ...	10s.
9.	Cotton braided wire and ditto. ditto. ...	9s.
10.	Heavy rubber ("cab tire") covered twin wire run on insulated hooks or metal clips ...	12s.
11.	Enamelled and braided wires	10s.

Nos. 1 and 2.—Not usually used for small installations.

No. 3.—Usual practice ; value depends greatly upon accuracy of fit (*i.e.*, quality) of the conduit used and the workmanship ; mechanical protection good in dry and non-corrosive situations.

No. 4.—Mechanically weak, but electrically sound in dry situations.

No. 5.—Somewhat weak mechanically, particularly adapted to surface work ; electrically very good, owing to whole system being concentric and with sheaths at earth potential ; neat and easy to fix ; very necessary to employ the full line of fittings and accessories provided by the makers. A few of the latter are capable of improvement in mechanical detail. This system has already attained great success, and it appears that its skilful inventors are about to receive flattery of the proverbially sincere order.

No. 6.—An old system which has had less attention in this country than it merits, suitable for any situation, dry or damp ; in the latter, at least, the lead sheath should be made continuous and earthed. The softness of the sheath renders it useful for fitting to building outlines, but constitutes some disadvantage with regard to mechanical strength. A considerable amount of house wiring has been carried out with this material, the insulation, however, being of paper, and although more permanent than the rubber, care must be taken to exclude every trace of moisture by sealing all outlets and joints ; for this reason its use can only be recommended where conscientious treatment may be relied upon.

Nos. 7, 8 and 9 belong to the group of so-called Continental systems which, unfortunately, have never been given a fair trial in this country, the objections being lack of safety and unsightly appearance ; it may be deduced that no great danger is to be feared from their use even with 250 volts, seeing how generally they are found in wooden buildings on the Continent, and also how well our own commercial flexible cord behaves under the treatment which is meted out to it in shops and warehouses.

The security of wiring systems of this class lies in their very insecurity ; being fixed upon the surface with the good secondary insulation of the porcelain cleats, and always within sight, they escape rough treatment, because it is obvious that they cannot stand it, even as windows are seldom broken, because it is understood that they must be treated with respect.

The argument against the appearance of this class of work is sound, but certainly exaggerated when applied to small flats, villas and cottages.

To those who would seek an opportunity of using one of these methods, it may be pointed out that No. 7 is less satisfactory than No. 8, the flexible wire offering more difficulty in producing a neat effect and showing an accumulation of dust to a greater extent than the two single wires. The latter are also easier to joint, and, with an ample selection of insulators for corner and special work, may be made to look very workmanlike. On small installations where the section of the copper is not changed, the joints may be neatly and safely made with these surface systems, so saving the extra cost of "looping-in." No. 11 promises to constitute a neat and useful substitute for No. 8. The use of enamel for the insulation of lighting wires is quite new, and the material now being put forward is deserving of careful attention.

No. 10, a comparatively new form of cable, was designed for rough use with hand lamps and portable tools ; it offers a ready means of running radiator and cooker circuits, and is also valuable for use in stables and positions where damp and corrosive liquids are found.

Only by actual and fairly extensive trial can a just estimate be formed of the value of these systems for different purposes, and it behoves every electrical contractor to make opportunities for the trial of any material which offers a reasonable chance of reducing installation costs, whilst complying with the requirements of safety.

SOME OF THE EXHIBITS AT OLYMPIA.—III.

(The figures in parentheses are the numbers of the stands.)

Sunderland Forge and Engineering Co., Ltd. (99, 116),
Pallion, Sunderland.

At this stand, which was one of the very first to be completed and equipped, the Sunderland Forge Co. have a varied exhibit of comparatively heavy machinery, mainly intended for use on board ship. The most prominent feature, perhaps, is one of 17 combined

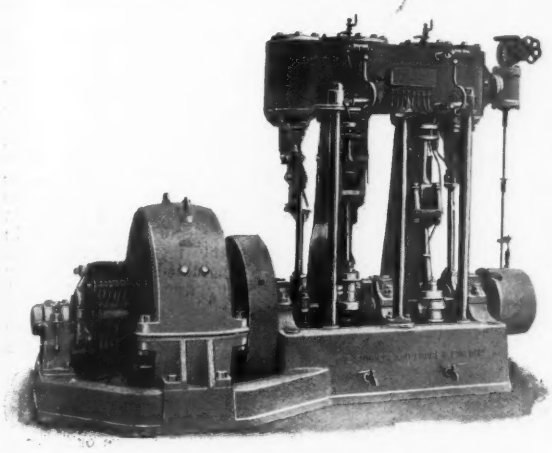


Fig. 102.—Standard Ship Lighting Set.

sets built for the Ocean Steamship Co., for their Australian vessels; this comprises a standard open type vertical compound engine coupled direct to a D.C. six-pole compound-wound dynamo, giving 35 KW. at 100 volts, 275 R.P.M. The substantial construction and good finish of the set, which we illustrate in fig. 102, are worthy of commendation.

Two other steam dynamos, of 15 and 3 KW. respectively, are also shown. Our other illustration, fig. 103, represents a silent-running electric boat winch to lift 2 tons at 70 ft. per minute; this has two warps, driven through single-reduction worm gearing by a D.C. series-wound motor, and is provided with a water-tight controller fitted with Blair's patent interlocking gear, a magnetic brake and a foot brake. The interlocking gear connects the foot brake with the controller, so that on depressing the brake treadle the controller is instantly thrown off and the magnetic brake also applied. This allows the operator to use both hands in hauling, stopping the winch with his foot when necessary. Four of these winches are installed on the *Olympic*, as well as four larger ones, and they have also been supplied to the *Titanic*, *Adriatic* and other "White Star" liners.

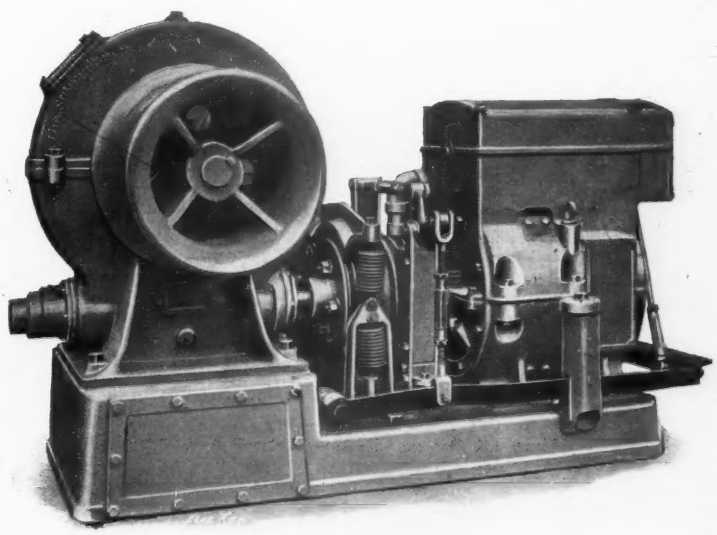


Fig. 103.—Silent Running Electric Boat Winch.

In the centre of the stand there is a standard 3-ton electric winch for shipyard use, lifting at 60 ft. per minute; this is driven by a totally-enclosed D.C. series motor through double-reduction spur gearing, and has two warps and a barrel; two foot brakes and a clutch for disengaging the barrel are provided. These winches are shown in operation. Three-phase induction motors and D.C. shunt-wound motors of various sizes complete an excellent exhibit.

The Eyre Smelting Co., Ltd. (263),
Tonbridge, Kent.

This firm exhibits its "Bamber's" non-encrusting zincs for primary batteries, a number of special registered tapered designs being shown which are claimed to be improvements over the ordinary zincs, the patterns being thicker at the greatest wearing part, which greatly prolongs the life, the wastage of zinc being considerably reduced. Zinc rods for Leclanché cells are shown, the special features being the following: The greatest sectional area is where the heaviest work takes place, and this has been adopted after repeated successful tests. The rods wear evenly to a very fine point, instead of in the middle. The wires, being cast in, do not become loose and drop out as a result of the creeping of the electrolyte; a constant and even flow of current; no cleaning beyond an occasional wipe with a damp cloth; no loss by local action. The company is also sole manufacturer of "Eyre" anti-friction white metal for lining all classes of bearings. The metal is used by railways, electric tramways, and for marine and machinery bearings, and ingots and samples of different brands, as also of lined brass bearings are on exhibition.

Messrs. A. Reyrolle & Co., Ltd. (147),
Hebburn-on-Tyne.

This Tyneside firm is making a special feature of switch-gear embodying the all-armoured principle, particularly such as is required in mining work.

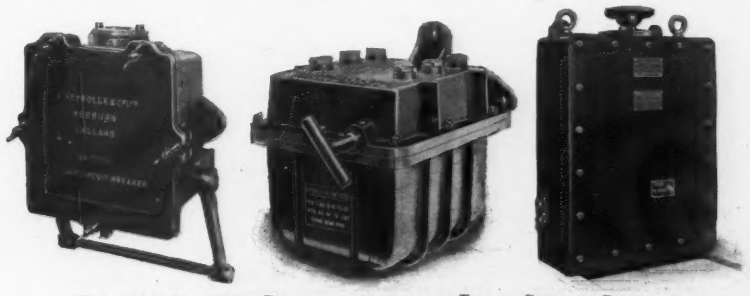
Messrs. Reyrolle's originality in switch design is, of course, very well known; they claim the maximum of safety with their system, even under such trying conditions as are often found in mining work.

The outstanding exhibit is a 20,000-volt 5,000-KW. sub-station panel, eloquently labelled "No danger," and similar to those shown in our view of a sub-station (fig. 107).

Unskilled labour is employed on the stand to demonstrate the ease with which the panel can be withdrawn for inspection and manipulated. The panel is provided with a carriage (similar to that shown in our view), and a bell-ringing device is fitted to show when the switch operates, either automatically or by hand. A smaller panel of similar type is also on view, as also a variety of ironclad mining switchgear. This includes a draw-out pillar type gear, mounted on a substantial cast-iron pillar with the bus-bars in a chamber at the top, the switch being arranged to plug into suitable contacts, and to slide on rails.

The interlocking gear is on the right-hand skid, and the arrangement is such that the switch handle must be in the "off" position before the switch can be withdrawn from contact with the bus-bars, and a swing door is provided which can be locked in position, in order to cover the contacts when the switch is removed.

The advantages of this gear will be obvious in that, in the event of adjustments being required on the switch itself, it can be readily drawn out and taken to "bank" without disturbing any other part of the gear, or if work is necessary on the cable controlled by one of these panels, it is only necessary that the switch should be drawn out sufficiently far to enable the swing lid to be locked in position, after which there is, of course, no possibility of



Figs. 104, 105, 106.—Reyrolle Explosion-Proof Circuit Breaker, Oil Switch, and Starter.

the cable being made alive. This gear is made in two styles, viz., explosion-proof and dust-proof.

The well-known "Fisher" gate-end box is shown. We illustrate a special explosion-proof drum-type starter, an explosion-proof oil switch, and an ironclad circuit-breaker

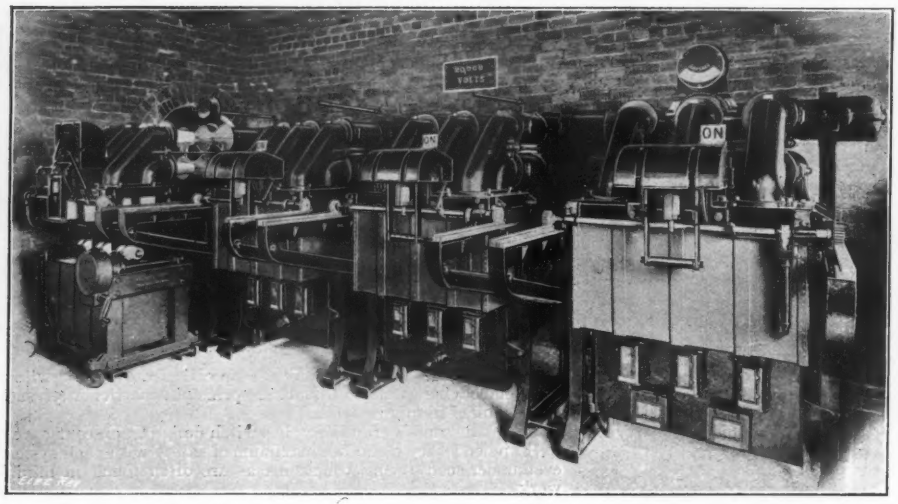


FIG. 107.—REYROLLE 5,000-KW. 20,000-VOLT SWITCH PANELS.

The now well-known Vernier H.T. cable joint, and a selection of relays and transformers used in the Merz-Price protective gear will appeal especially to mains engineers.

As will be gathered, the exhibit is of great technical interest, and well worth inspection.

The Leskole Co., Ltd. (222),

Palace Works, Enfield.

This company shows a complete range of electrical instruments for the purpose of recording all industrial temperatures from 300° to 3,000° F. in actual use. The exhibits are in two sections, one for electrical resistance thermometers for use particularly in power plants, and for the lower temperatures up to 1,000° F., and the other of thermo-electric pyrometers for high temperatures. Complete temperature control switchboards for central stations, comprising temperatures of cooling air and water, feed water, steam, superheat, flue gases, transformers, &c., are shown, including an entirely new system of push-button switches. Demonstrations are also given of high-temperature instruments, suitable for boiler furnaces, destructors, hardening and annealing furnaces, &c. These thermometers have been successfully adapted to indicate or record the temperature of armature windings. An automatic recording instrument for producing continuous records of the temperature at several points (up to six) simultaneously, is shown working.

The company also shows indicating and recording steam meters; the way in which the disk which is used to determine the speed of the steam is placed in the pipe and connected to the instrument is shown in fig. 108, and fig. 109 is a view of the complete panel fitted with an integrating meter, voltmeter and regulator. The quantity actually measured is the difference of pressure between the two orifices 2 and 3 on opposite sides of disk 1; the mercury gauge 4 is actuated correspondingly by way of pipes 5 and 6, which are fitted with loops 7 and 8 to prevent errors due to unequal condensation of steam on the two sides of the gauge, and sediment collectors 9 and 10. The mercury in the gauge, touching more or fewer of the platinum contacts fused into the glass tube, varies the rate of the integrating meter. It will be noticed that the indicating or recording instruments are of well-known electrical types. Various patterns are made, either indicating, integrating, or graphically recording the steam used.

Draft and pressure gauges are shown in various patterns, as well as chart recorders for draft, pressure, vacuum and differential measurements. The circular type of chart is employed, and the gauges are chiefly remarkable for their solid and sound construction and beautiful finish. The new vacuum recorder for condensing plants, &c., is the first placed on the market for this purpose, based on the mercury U tube.

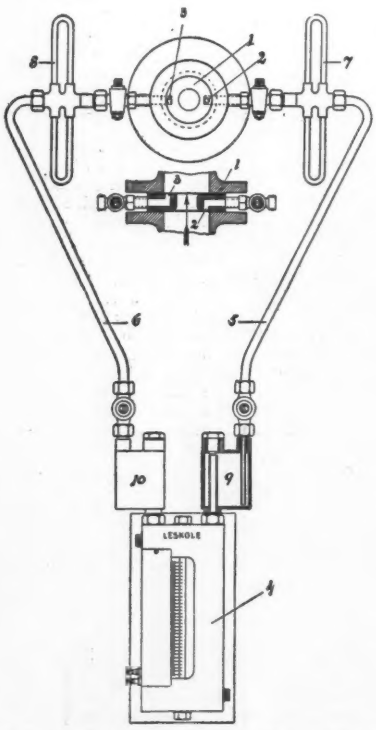


FIG. 108.—ARRANGEMENT OF STEAM METER.

FIG. 109.—STEAM INTEGRATING METER, WITH VOLTMETER AND REGULATOR.

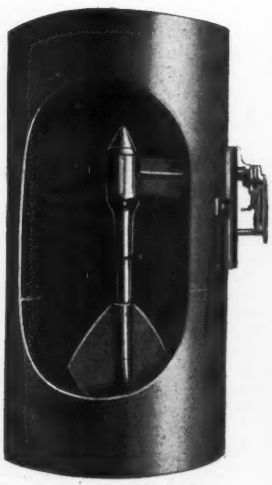


FIG. 110.—COAL METER.

On this stand can also be found examples of all the various types of mercury thermometers used by central station engineers and others engaged in the electrical industry.

An apparatus which will attract considerable attention is the Leskole coal meter, fig. 110, a new device for automatically recording the weight of coal passing through chutes feeding mechanical stokers, &c. The construction of this meter is exceedingly simple, and its

price very moderate: engineers are invited to install these instruments on trial in order to test out the accuracy for themselves.

The Leskole leak detector, too, is an interesting little device for the purpose of telling at a glance whether a steam trap is out of order or leaking.

Pope's Electric Lamp Co. (207, 208),

Hythe Road, Willesden.

The arrangement adopted for this stand is intended to convey to the visitor, by means of a brilliant display of Pope lamps in the neighbourhood of a lighthouse, that the right way to a light-house can be found by using these lamps which are manufactured at Willesden. Little need be said concerning the merits of the lamps,

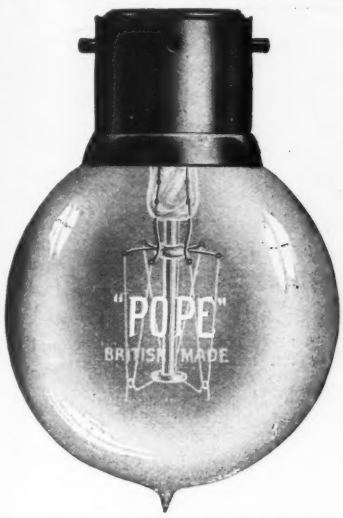


Fig. 111.—Pope Tungsten Lamp for Train Lighting.

Fig. 112.—Pocket Lamp by Messrs. Jacobs.

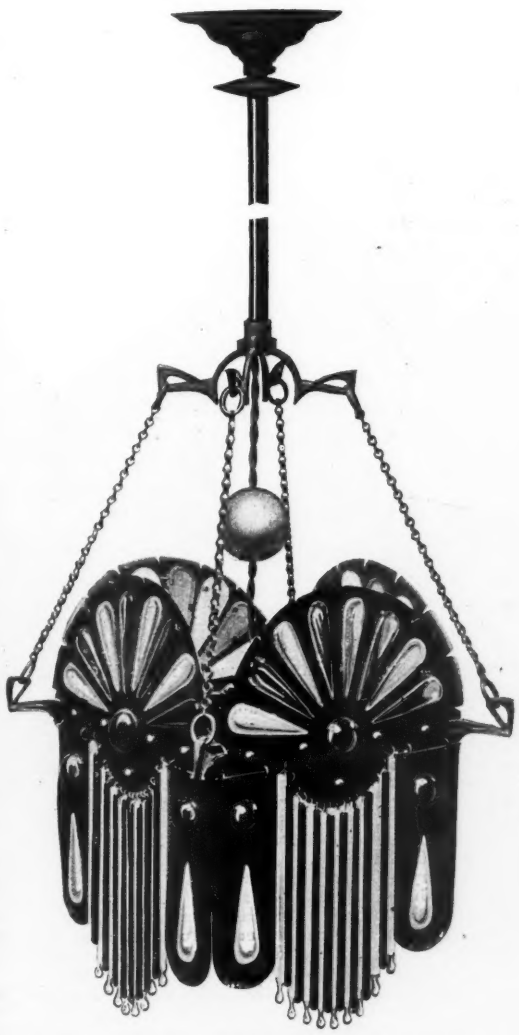


Fig. 113.—Hall Fitting by Messrs. Jacobs.

as they are familiar to our readers. In addition to the standard lamp for high and low voltages there will be seen twisted flame candle lamps, with either clear or frosted bulbs, ranging up to 125 volts and in 13 to 16 c.p.; olive or plain flame lamps and tubular lamps are shown, ranging from 25 to 125 volts, in 5, 12 and 16 c.p. sizes. Attention may be directed to a new metal lamp for shop window lighting, the filaments being so suspended that notwithstanding the great length of the bulb they will stand reasonable vibration and rough usage. These lamps are made to any standard voltage, and the c.p. range is from 25 to 50; they have three-pin caps and reflectors. The three-pin cap assures rigidity and obviates the necessity for placing a cap at the other end of the bulb. This lamp is also serviceable for picture lighting. Other exhibits comprise lamps for motor-car lighting; the "Pope" Focus lamp, which is suitable for head or side lighting; and a handy festoon lamp for automobile interiors. For train lighting the firm makes the lamp shown in fig. 111. It is supplied for 16 to 24 volts and for 8 to 16 c.p. A feature that should also be mentioned is a special type of radiator lamp, made in all voltages for fitting to any standard form.

Messrs. W. & R. Jacobs (296),

39c, *King William Street, E.C.*

Glass shades and fittings of every description for electric lighting are in evidence here; there are nearly 150 designs ranging in value from the cheapest to the most costly. It is never easy to find much to say about exhibits of this kind, and indeed they generally speak

Fig. 114.—Stokvis Dutch Fitting shown by Messrs. Sparkes.

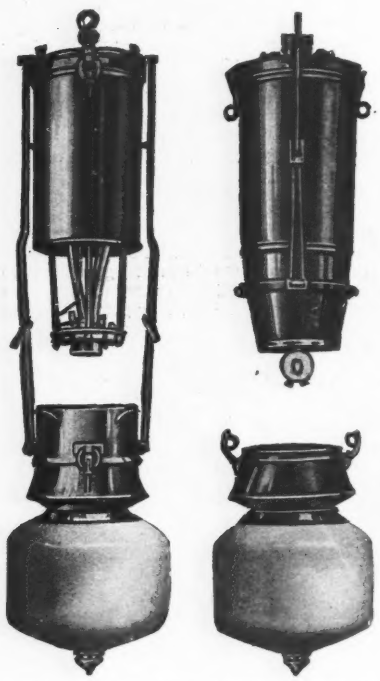
far more effectively for themselves, so we will let them do so on this occasion. To that end we select a design which seems to us to be a departure from the ordinary run of such goods, fig. 113 representing a hall fitting in copper finished metal, jewelled, and with glass drops. The firm's catalogue contains many other choice examples of fittings of the same class, also standard lamps, and innumerable shades. A popular line on the stand is a large selection of electric pocket flash lamps and torches—in all over 50 patterns, one of which is lighted by turning the lens instead of having a switch at the side—and many other electrical novelties.

Messrs. E. C. Sparkes & Co. (235, 235a),

118 *and* 120, *Wardour Street, London, W.*

This firm being agents for Messrs. Peyton & Peyton, Ltd., of Birmingham, and for Mr. W. J Stokvis, of Arnhem, Holland, they show the electric-light fittings manufactured by both. Messrs. Peyton have a long record in brass and iron work—some 70 years—

and their designs of electric light fittings shown, are prepared by their own draughtsmen in all styles, and to suit most pockets. Representative examples of their fittings for private and public buildings, theatres, churches, &c., can be seen at the stand or at the showrooms in Wardour Street. The firm of W. J. Stokvis are likewise of long-standing. They have made a special study of the reproductions of the genuine old Dutch lighting fittings of the sixteenth and seventeenth centuries, as revealed by the examples in



FIGS. 115 AND 116.—ANGOLD MAGAZINE FLAME ARC, G.E. CO.

FIG. 117.—PHOTO ARC LAMP, G.E. CO

the Amsterdam and Haarlem Museums. We understand that they are the only firm which have received permission to make plaster casts from antique models at these museums. They also reproduce the fittings from the paintings of the old Dutch masters, such as Gerard Don, D. Teniers, jun., G. Metsu, N. Maes, &c., and on the walls of the stand will be observed some engravings showing how these have been copied. It is interesting to recall that a great many of these old painters included in their interior paintings a candelabra, a lantern or a candle-stick, and it is after these that Messrs. Stokvis have prepared many of their fittings. The firm also make a speciality of fittings in French styles, and several fine specimens of these are shown. The fitting which we illustrate in fig. 114, is from a painting ("Amateurs of Music," by Gabriël Metsu) in the Royal Art Gallery at the Hague.

General Electric Co., Ltd. (103, 112, 125, 134),

67, Queen Victoria Street, E.C.

It is almost unnecessary to say that everything electrical which the public may be expected to take an interest in, can be found on the several stands of the General Electric Co., as well as many other things which appeal particularly to the engineer.

FIG. 118.—CONVERTIBLE IRONING, COOKING AND BOILING APPARATUS.

A casual inspection, such as that which the company kindly arranged on behalf of the Press during the opening week, revealed many interesting novelties, amongst which the most important is undoubtedly the new 16-C.P. 20-watt metal lamp for 200-240-volt circuit. The filament is jointless, and occupies a small bulb; moreover, it will stand severe handling, and for those who will have a small lighting unit, it appears to be ideal. Naturally the Osram lamp is a great feature of the firm's stand, and in its various sizes up to 1,000 C.P.—a unit which has beeen adopted for street lighting at Torquay and Sutton Coldfield with satisfactory results—provides an attractive display. A case of veteran Osrams, with up to 10,000 hours' burning to their credit, is worth noting, as also the interesting devices which demonstrate the strength of the Osram filament as now manufactured.

From lamps to fittings is a comparatively short step; needless to say, the fittings' display is a comprehensive one—a novelty being the "basket work" pendants, standards, &c. The lighting exhibits

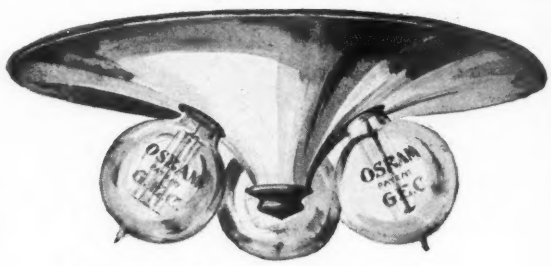


FIG. 119.—G.E.C. STREET LIGHTING FITTING.

also include arc lamps, large and small, for all purposes, and the well-known "Robertson" carbon lamps are shown in course of manufacture.

A variety of cooking and heating apparatus, made under the "Archer" patents is shown; the various articles in this section should be carefully inspected. Demonstrations of the simplicity and utility of the cooking appliances have been arranged.

Among the many exhibits to which we can give only passing notice may be mentioned the "Freezor" fans and punkahs; electro-medical vibrators and ozone apparatus; miscellaneous accumulator, lamp and bell supplies; a wide range of central battery, magneto and battery-call telephone switchboards and wall, desk and field instruments; and an imposing miscellany of electrically operated devices of every description.

The measuring instruments exhibited range from the cheap round switchboard types to such laboratory instruments as the Sumpner wattmeter. The meter exhibit (by the Aron Electricity Meter Co., Ltd.) is exceptionally complete, and includes the standard clock type Aron meter, for house or switchboard service, shunted in the heavy current patterns; polyphase clock meters for three or four-wire circuits, and various motor type meters, among which may be mentioned the induction type for single and polyphase measurement, and the ampere and watt-hour types for continuous currents. Recent improvements in Aron meters include the introduction of silent winding gear, help springs and the springing counter. We

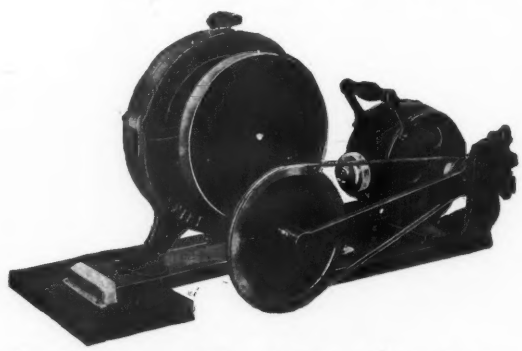


FIG. 120.—ELECTRIC "MARY ANN" AND KNIFE CLEANER.

understand that the Aron prepayment meter for alternating current is the only one approved by the Board of Trade. Among the special meters exhibited may be noted the combined meter and maximum demand indicator; the two-rate supply meter; the double dial battery meter—integrating on one dial the charge input and on the other the discharge output (in ampere or watt-hours)—and the single dial pattern—recording discharge in a clockwise and charge in an anti-clockwise direction. In the latter instrument an automatic relay slows up the charge registration by a percentage equal to the desired percentage excess of charge over discharge; the dial pointer thus indicates the state of the battery. Other integrating and indicating instruments shown by this firm include various combinations of motor meters, portable standard meters and accessories, time meters and switches, high-tension transformer instruments, speed indicators, taximeters, electric clocks and so on, almost, the visitor might think, *ad infinitum*.

In the plant section we noted the "Witton" semi-enclosed, shunt-wound continuous-current motors varying in size from $\frac{1}{10}$ to 110 B.H.P. and wound for any standard voltage. According to requirements, these machines are supplied in various designs of the open, protected, semi-enclosed, totally enclosed and waterproof

patterns. Standard alternating-current motors for ¾—50 B.H.P. at 1,450 R.P.M., 50 cycles, and for one, two or three-phase circuits, are exhibited, in addition to a variable-speed three-phase motor controlled by regulating resistances. D.C. and A.C. small-power Witton motors are shown coupled to various domestic appliances, and the electrical "Mary Ann" and portable "Kleenall" and larger size vacuum cleaners will doubtless be of general interest.

A novelty somewhat resembling the "Kleenall" is a motor-driven floor polisher, the motor, which operates a circular polishing brush, being mounted on a broom handle.

A vertical oil engine direct-coupled to a 2-KW., 50-75-volt shunt generator is typical of the plants recommended by the G.E. Co. for house lighting or isolated power supply in general.

A large variety of switches and controllers of every description is effectively displayed, and is supplemented by a number of high and low-tension accessories; the "Hoadley" current limiter and the "Record" circuit-breakers and automatic battery cut-in and -out gear are worthy of special notice Various types of lighting, power and telephone cables are shown, together with a new range of "Flame Resisting" wires and cables; the conduits exhibited include enamelled and sherardised types, the "Geekoduct" insulated conduit and a complete range of accessory fittings.

Messrs. Wright & Wood, Ltd. (129, 130),

Halifax.

This firm has a representative display of its standard lines in motors, generators, &c., and combined sets on view. These include a ball-bearing rotary converter, typical of some 16 standard sizes;

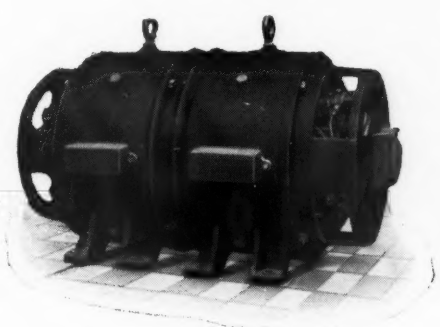


Fig. 121.—Duplex Motor-Generator

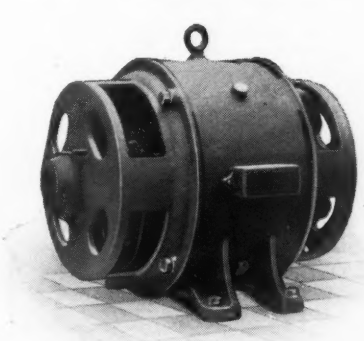


Fig. 122.—Single-Field Rotary Transformer.

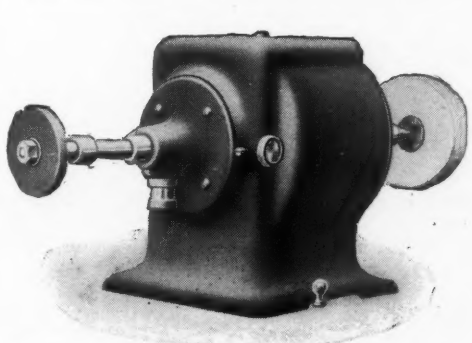


Fig. 123.—Electrically-Driven Polisher.

a rotary transformer for cell charging, and a new duplex type cinematograph motor-generator for 460/65 volts, and 1,100 R.P.M. This is a very compact and rigid machine, as may be seen in our view, fig. 121; it needs no bedplate, and cost, space and weight are much reduced; it is made in 14 standard sizes.

We illustrate in fig. 122 another of the firm's specialities for cinematograph work—a rotary transformer of the single-field type, for 460/65 volts and 1,100 R.P.M., which again is built in 14 standard sizes, as also are the ordinary type motor-generators exhibited both on this stand, and on that of Messrs. Ozonair, Ltd.

A range of ball bearing and other motors, of from ⅛ H.P. to 3 H.P. (230 volts), is on view, including a variable-speed interpole motor.

Fig. 123 shows one of the firm's electrically-driven polishers, examples of which can be seen on the stand.

Union Electric Co., Ltd. (101, 114),

Park Street, Southwark, S.E.

Naturally, this stand is well equipped with arc lamps; the Union Kohinoor semi-enclosed type, in various patterns for D.C. circuits, and the Union Excello flame arcs, which have attained so great popularity, are freely disposed about the area, with a variety

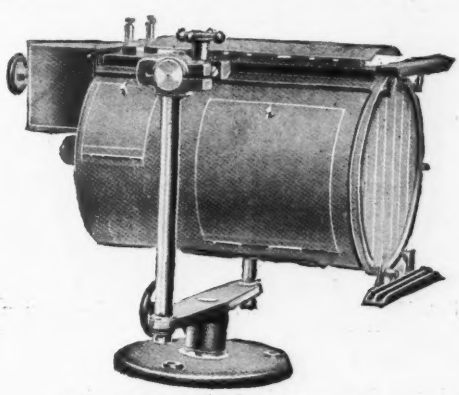


Fig. 124.—Searchlight Projector.

of accessories. The Union Triplex Kohinoor, which can be run three in series on 220-250 volts D.C., and various other arc lamps are also shown, including a number of photo-printing lamps. Searchlight projectors are represented by several examples, one of which is shown in fig. 124; this is specially designed for indoor use, or outdoors under cover, and is provided with an automatic arc and solid metal mirror. Larger projectors for ships' use and other purposes, and cinematograph projectors, are included.

The heavier branches of the company's work are also well represented. The largest item is a 100-KW. dynamo, with commutating poles, and a motor-generator supplies current to the stand for

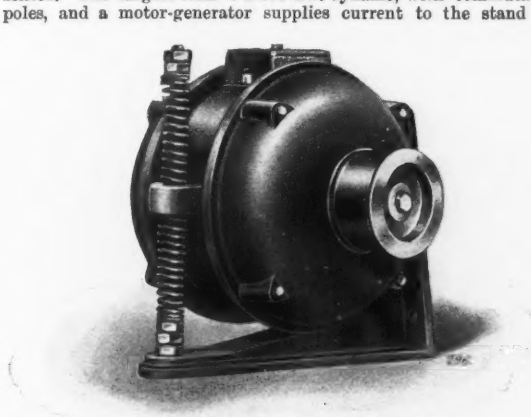


Fig. 125.—1-H.P. Loom Motor

lighting and power An interesting exhibit is a submerged motor and pump, the water being in actual contact with the insulated windings.

We illustrate in fig. 125 a 1-H.P., A.C. loom motor with flexible cradle suspension; similar motors are made of smaller and larger sizes, with high efficiency and power factor, and large starting torque. Various examples of the Union standard V-pattern dynamos and motors are also shown, embodying such features as forced ventilation, wide speed variation, &c., and A.C. induction motors.

Another item is a petrol-electric generating set for country houses, bioscope shows, &c., the engine being specially designed for continuous running at full load; this can also be adjusted to run on paraffin. An electrically-driven friction hoist designed for the use of builders, warehouses, &c., is included in the exhibit.

One of the company's strong lines is switchgear, of which a variety of patterns are shown. The "Fortiter" automatic field regulator, which cuts out resistance by means of a mercury trough

actuated byla solenoid with' movable core, is a noteworthy item, its simplicity being a valuable feature. An automatic apparatus for paralleling alternators is also worthy of mention, being equipped with relays depending upon phase and voltage, which interact so that unless all the necessary conditions are simultaneously satisfied the paralleling switch cannot act. When, however, the proper values are attained, a circuit is closed which operates a pull magnet on the switch of the incoming generator; the latter is provided with

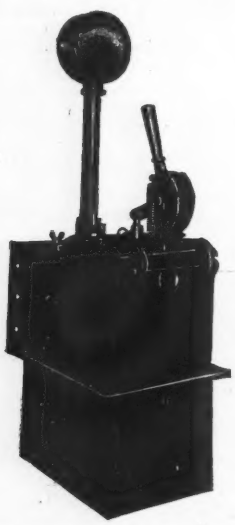


FIG. 126.—UNION MINING SWITCH-FUSE.

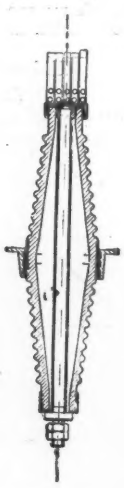


FIG. 127.—SECTION OF PORCELAIN INSULATOR.

a time-element device, which ensures that the switch shall not be closed unless synchronism is actually maintained for an adequate interval. One such apparatus serves for paralleling any number of generators, if the pressure transformers and automatic switching-in apparatus of each machine are suitable for connection to the device.

Mining switchgear is, of course, to the fore; the company show a number of panels suitable for use above and below ground, one of which we illustrate in fig. 126. This is a switch fuse with ammeter for motor control, the switch breaking under oil; many hundreds of such switches, we understand, have been supplied by the Union Electric Co. to collieries in this country. An automatic starting

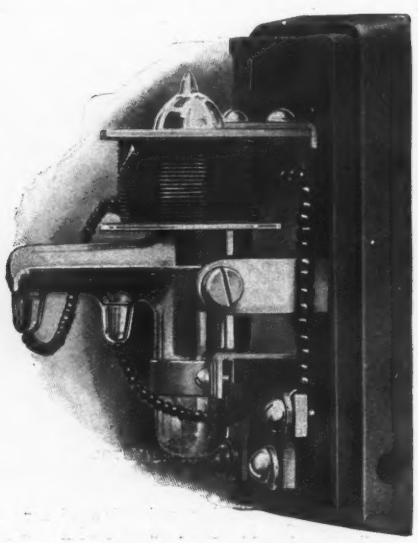


FIG. 128.—UNION CURRENT LIMITER.

rheostat, without dash-pots, in which the rate of switching on is controlled by a pendulum movement and relay, is a novel feature, and mention must not be omitted of the oil-break switches for pressures as high as 20,000 volts. The porcelain insulators used in these are made as shown in the accompanying section, fig. 127, this type being adopted for all pressures above 6,000 volts. The porcelain insulator is hollow, with walls of uniform thickness, and the copper conductor passing through it is further insulated with a tube of non-hygroscopic material; the insulators are fitted into cast-iron flanges screwed into the top of the switch, and can be removed bodily with the conductors. Switches thus designed for 10,000 volts have a breakdown pressure as high as 47,000 volts.

Space is wanting to deal with the extensive display of instruments exhibited, of the Hartmann & Braun type, stationary and portable; we can only, in conclusion, mention a current limiter (fig. 128), consisting of an exhausted glass tube with a horizontal leg, into which two series platinum contacts project; in the tube is mercury and an iron float, and round the upper part of it is a solenoid in series with the main circuit. When the predetermined current is exceeded, the float is drawn up, the level of the mercury falls, and the connection between the platinum contacts is thus broken. The design is obviously simple, the adjustment easy, and there are no wearing parts.

Messrs. W. Lucy & Co., Ltd. (96),

Oxford.

Messrs. Lucy's stand is something of a Mecca for the mains engineer; certainly the selection of disconnecting and joint boxes, feeder pillars, fuse boxes, and street lighting fittings, shown by this firm, bears out their contention that they supply "everything for outside work, except cable." Street lighting fittings for metal-filament lamps are quite a feature of Messrs. Lucy's business, and it is to be hoped that members of street lighting committees

FIG. 129.—LUCY STANDARD FEEDER PILLAR.

on tour will inspect some of the various patterns of lamp shown on this stand.

Messrs. Brunner, Mond & Co. (260),

Northwich.

A simple but very effective pedestal showcase contains samples of the various chemical products of this firm, directly interesting to electrical engineers. Blocks of zinc and cadmium (of guaranteed purity 99·95 per cent. and 99·5 per cent. respectively), are placed between bottles containing powdered muriate of ammonia (98·5 per cent. AmCl), and the well-known "Voltoids" (compressed ammonium muriate). Where the latter material is required for use in considerable quantities (in tinning, jointing and so on) the rectangular 18-oz. bars of "Salamac" offer a convenient form

The "Trident" Co. (281),

60, Water Lane, S.W.

Among a number of useful workshop tools and devices, we notice especially the "Grip" belt fastener. The construction and application of this fastener will be obvious from fig. 130. A number of Λ-shaped pointed staples are fitted with a slotted-strip holder

Fig. 130.—The "Grip" Belt Fastener.

as shown. Being thus held at the correct pitch, one set of staples is fixed to each end of the belt to be joined by hammering on a shaped anvil (as illustrated) or by the use of a special lever press. The two rows of staples are then intermeshed (or "sandwiched") and pinned, and the joint is complete. It is smooth and strong, and instantaneously uncoupled should occasion arise. A metal pin is sometimes employed, but hemp, cane or raw hide is amply strong (owing to the large number of shear sections concerned), and needs no special securing. It is difficult, with the hands alone, to break a single strand of cotton threaded through the meshed staples. The cost of this coupling is trifling, and the device can be fitted and manipulated by any person.

The Lancashire Dynamo and Motor Co., Ltd. (122, 137),

Trafford Park, Manchester.

The company's most interesting exhibit is a 4 ft. × 4 ft. × 10 ft. Buckton planer fitted with the "Lancashire" patent reversing motor drive. This drive has been so successful that upwards of 150 equipments have been supplied during the last 18 months. Some particulars of the machine were given in our reference to Messrs. Buckton's exhibit (September 22nd, p. 467). Special attention is called to the accelerating device in the form of a small switch which is worked by adjustable stops on the planer table. It has two functions:—(*a*) Speeding up between cuts when two or more surfaces some distance apart are being planed; (*b*) speeding up when the tool has entered the work so that higher cutting speeds can be used without extra wear on the cutting edge of the tool. If necessary, the table can be retarded before the tool leaves the work, so that the end of the work is not broken. This has never before been done on any system.

The "Lancashire" method of driving a planer or other tool by a reversing motor includes a motor-generator supplied with either alternating or direct current. The generator is connected electrically to the planer motor, which is direct coupled or geared to the planer driving shaft. This generator and motor are direct-current machines, and may be wound for any convenient voltage.

A reversing switch is actuated by one light tappet rod from the reversing gear of the planer. When this is thrown over, it reverses the direction of the current in the field winding of the generator, thus reversing the direction of rotation of the planer motor. At the same time it so regulates the voltage of the generator as to cause the planer motor to run at the speed required, according to whether it is on the cutting or return stroke.

The cutting speed may be varied by hand to suit the work being done by means of a regulating resistance in the generator field. This gives a constant return speed, but if desired the return speed can be varied also.

A very interesting display of motors is given, in the design of which many new improvements are embodied. Various standard types of enclosure are shown, and from these a motor may be chosen suitable for practically any industrial drive. It is the firm's standard practice to fit endplate type induction motors with ball bearings.

Amongst the above we may particularise a protected type squirrel-cage motor of 20 B.H.P. at 2,900 R.P.M. (three-phase 50 periods), operating a Hodges blower delivering 3,000 cb. ft. of air per minute; a semi-enclosed shunt-wound D.C. motor of 5 B.H.P. at 1,000 R.P.M., driving a Davidson fan, and a totally enclosed vertical-spindle squirrel-cage induction motor of 7½ B.H.P., direct coupled to a Watson Laidlaw hydro-extractor. The motor drives the extractor through an automatic slipping clutch, enabling the motor to start up light, and the load gradually comes on when about two-thirds speed has been attained. The motor is switched straight on to the mains, no special switchgear being, therefore, necessary.

A chimney-ventilated wound-rotor induction motor of 15 B.H.P. for colliery work, together with other examples of the firm's A.C. and D.C. work, complete a very valuable exhibit from the power user's point of view. Practically all the machines are fitted with suitable switchgear by well-known makers, and can be shown in operation.

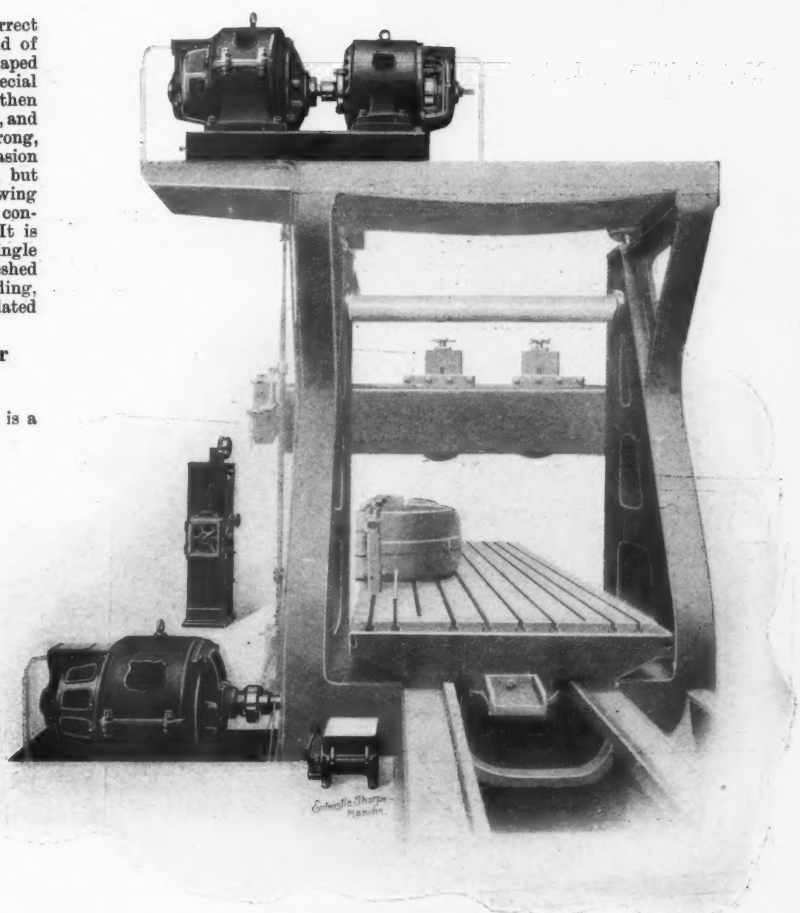


Fig. 131.—Planing Machine fitted with "Lancashire" Reversing Motor Drive.

C. W. Armitage (261).

Here those who are engaged in engineering works will find grease and oil-removing material, such as "Quixol" (for cloth, leather, &c.), and "Motol" (for the skin).

Bell Washer Co. (276).

To this stand there is a continual stream of interested visitors. The action of the machine exhibited is very easy, smooth and vigorous; the only improvement we can suggest is the addition of an electric motor.

Messrs. Berry, Skinner & Co. (129, 130).

78, Upper Thames Street, E.C.

No introduction is needed by our readers to the Berry switch specialities; suffice it to mention that a complete series of the Berry fool-proof gear is shown, including several recent patterns which are of more than passing interest.

FIG. 132.—ELECTRICALLY-DRIVEN HYDRO-EXTRACTOR.

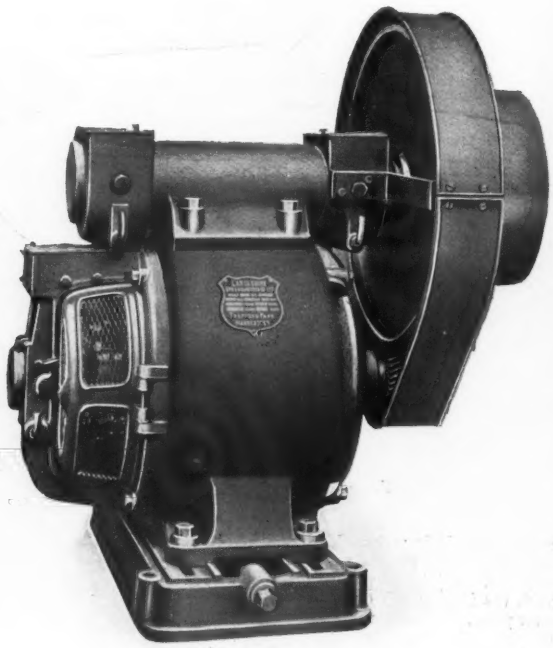


FIG. 133.—BACK-GEARED MOTOR.

LANCASHIRE DYNAMO CO.'S EXHIBIT (see p. 561).

One of these is the Firemine three-pole fused switch, which we illustrate in figs. 135 and 136. This is a very compact gear, with a heavy iron fool-proof and automatically interlocked case; it is provided with machine-faced flanges and well fitted cable glands. Only mica and metal are employed in its construction.

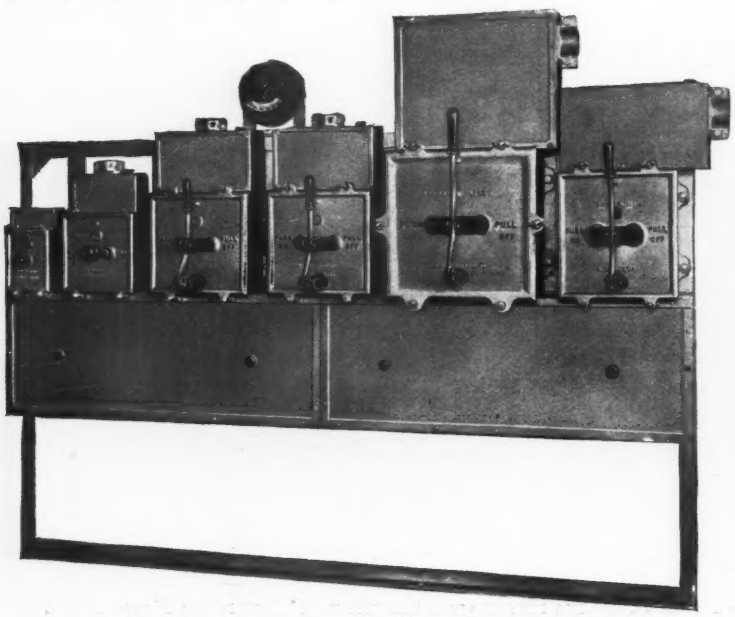


FIG. 134.—BERRY, SKINNER MINING SWITCHBOARD.

The switch contacts are controlled by carriage springs, and the mechanism and fuses are contained in the cover, which can only be opened when the switch handle is in the "off" position. Moreover, it is impossible to make circuit again without first fastening the cover on. Messrs. Berry, Skinner justifiably congratulate themselves on this apparatus, which has been tested as regards colliery application by Dr. Thornton, the well-known Tyneside expert, and appears to conform in every way to Home Office requirements.

Another speciality of this firm is built-up boards, for which their apparatus is very suitable. We illustrate in fig. 134 such a board for mining work, similar in type to one shown on the stand, for controlling five lighting and five power circuits. It is equipped with watertight Masta patent fused switches, trifurcating chambers, and armour clamps for cables; the bus-bars are enclosed in an ironclad chamber.

These boards are very compact, and as everything is get-at-able from the front, no back gangway is required, and none in front; in fact, we are informed that the estimated saving in freehold with a board of this kind is sufficient to pay for the latter in the course of two years or so.

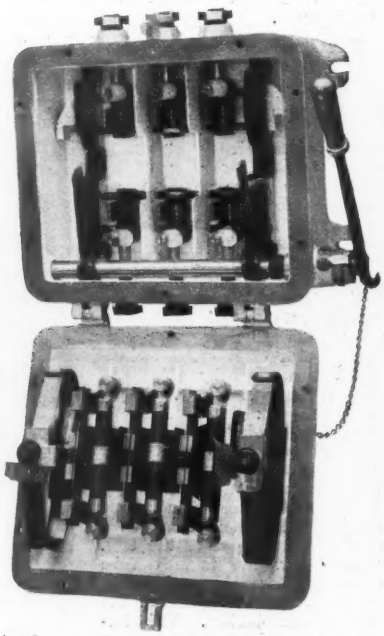


FIG. 135.—FIREMINE THREE-POLE FUSED SWITCH, OPEN.

In passing we may mention the Dreadnought patent switch fuse, designed for, and approved by, the Admiralty, and capable of submersion in 14 ft. of water if required. This switch is simply and strongly made, dust and flameproof, and possesses the fool-proof features of the Firemine type, to which it is constructively somewhat akin.

The Rockfeller oil-break fused switch, shown in fig. 137, is a new thing. This also is foolproof. Its peculiarity is that instead of removing the oil tank in order to get at the switch mechanism,

the switch and fuse parts are lifted out of the oil by the opening of the lid, leaving the live contacts submerged. This enables the

Fig. 136.—"Firemine" Switch, Closed.

fuses to be replaced without the slightest risk. It is also worth noting that the firm are now arranging their standard apparatus with single-cable inlets.

Messrs. Everett, Edgcumbe & Co., Ltd. (66),

Collindale Works, Hendon.

A wide range of instruments is shown at this stand, from which we have selected a few for special notice. Of these, fig. 139 shows a "watertight" pattern of instrument., which is particularly intended for installation on board ship, in dockyards, collieries and other places where it is likely to be exposed to severe climatic conditions. Instruments of this class, manufactured by Messrs. Everett, Edgcumbe & Co., are in use in very large numbers on practically all H.M.'s warships launched in recent years, to say nothing of those belonging to foreign navies ; they are all thoroughly watertight, and are subjected to a rigorous test under water at a pressure

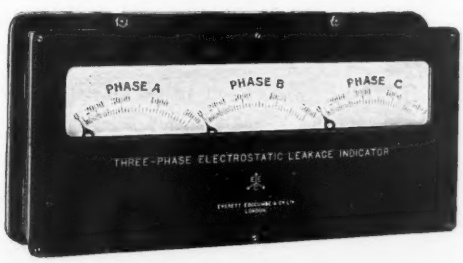


Fig. 137.—Three-phase Electrostatic Leakage Indicator.

of several pounds to the square inch. The water-tightness is as secure after the glass front of the instrument has been broken as before.

Besides Messrs. Everett, Edgcumbe & Co.'s well-known portable single and multi-range dynamometer wattmeters, they exhibit a

Fig. 138.—Induction Ammeter.

complete new line of similar ammeters and voltmeters, which can be used quite indiscriminately on A.C. and D.C. circuits. A number of induction ammeters, voltmeters and wattmeters are shown, suitable for both high and low-pressure circuits. The great advantage possessed by them lies in the extremely long and open scale available (covering some 300° of arc), so that for switchboard work where visibility at a distance is a *sine quâ non*, they find much favour. They have recently been supplied in considerable numbers to the L.C.C. tramways and other large undertakings. Special care has been devoted to the elimination of errors, and the clearness of the scale is well shown in the accompanying illustration (fig. 138).

Leakage indicators for use in mining installations have long been a speciality of this company, and their instruments have been widely adopted. Fig. 137 shows a set of three-phase high-pressure

Fig. 139.—Everett, Edgcumbe Watertight Ammeter.

electrostatic indicators combined in an earthed metal case, which is suitable for use not only in mines, but in any high-pressure installation. Another useful instrument is a "potential indicator," fig. 140, designed to show whether the mains or bus-bars with which it is connected are alive or not. Half the dial is coloured red and the other half is white, so that the indication of danger is easily visible at a distance. The instrument itself is entirely cut off from the high-pressure circuit by two special condensers, shown beneath it in the illustration.

Tramcar speed indicators of an electrical type and trolley standard earth detectors are other exhibits ; A.C. relays are made a special feature of the stand, much attention having been given to these instruments by the firm, both for overloads and for reverse currents,

Fig. 140.—Potential Indicator for Bus-bars.

The new "Graphic" recording instruments, which we recently described, the well-known rotary synchroniser in its latest form (with stationary windings), electrically operated ships' telegraphs, and various photometers, tachometers, fault localisers, &c., are included in the exhibit, which, it will be seen, contains features of interest to almost every electrical engineer.

Messrs. Galsworthy, Ltd. (244),

15 and 16, Newman Street, London, W.

Messrs. Galsworthy, whose exhibit is just a few stands to the right on passing through the main entrance, have a display of various electric light fittings and accessories. A part of the stand is devoted to a feature which, as we observed, was attracting considerable attention, namely, the "Otovacum" patent vertical direct-driven turbine vacuum cleaner. This is made in sizes for

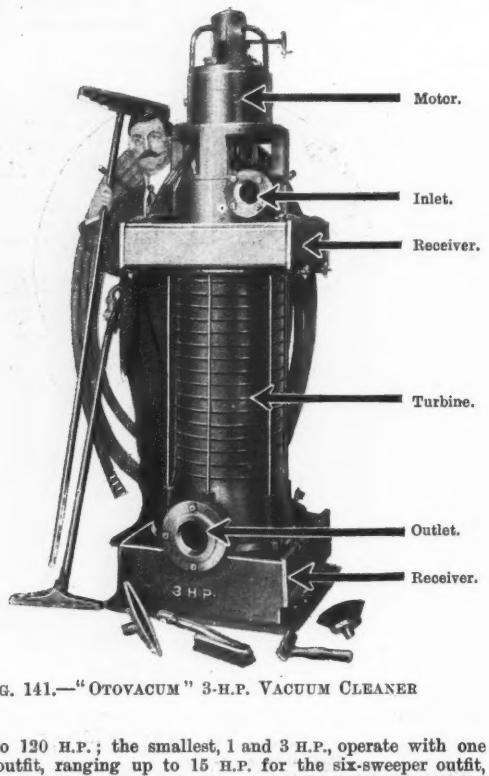


FIG. 141.—"OTOVACUM" 3-H.P. VACUUM CLEANER

from 1 to 120 H.P.; the smallest, 1 and 3 H.P., operate with one sweeper outfit, ranging up to 15 H.P. for the six-sweeper outfit, 30 H.P. for the 12-sweeper and 120 H.P. for the 50-sweeper outfit. A one-sweeper outfit will operate one renovator only, while a 12-sweeper outfit will operate 12 renovators simultaneously. The machines are vertical air turbines acting as powerful air pumps, and the shaft of the turbine is in each case coupled to the shaft of a vertical electric motor. There are no auxiliary wet dust

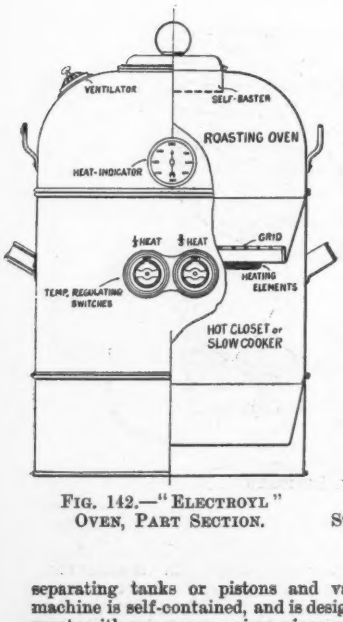


FIG. 142.—"ELECTROYL" OVEN, PART SECTION.

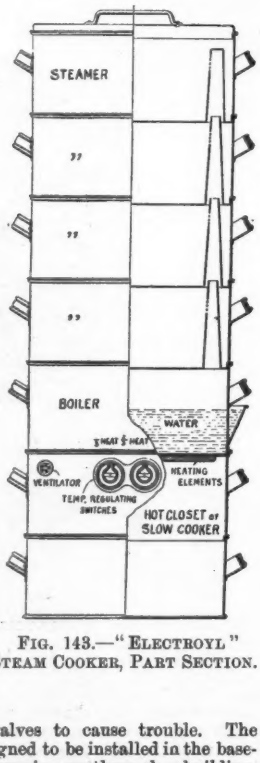


FIG. 143.—"ELECTROYL" STEAM COOKER, PART SECTION.

separating tanks or pistons and valves to cause trouble. The machine is self-contained, and is designed to be installed in the basement, with one or more riser pipes running up through a building, through which all dirt and dust is sucked down and deposited in the dirt-receiving pans of the cleaner. The foul air which results from any cleaning by suction is conveyed by a pipe from the exhaust end of the machine to a chimney or sewer. For the cleaning of hotels, residences, public buildings and many kinds of factories the cleaner is recommended. The 3-H.P. sweeper outfit comprises two 25-ft. sections of suction hose, floor handle, wall handle in two sections, hand tool for upholstery, carpet renovator, bare floor tool and three brushes.

Messrs. Purcell & Nobbs (159),

87-89, Cleveland Street, W.

The most interesting novelty shown by this firm is the "Electroyl" patent oven; the "Electroyl" system of radiators—or rather, convectors—is well known, but this is quite a different thing. The essential feature of it is the arrangement of the heating element horizontally in the centre of the oven closely applied to the underside of a pan, as shown in the accompanying section, fig. 142. The oven is made in three parts, forming two compartments: the upper is the roasting oven, and the lower, heated by radiation downwards from the heater, is a hot closet or slow baking oven. Access is gained to the upper compartment by lifting off the top section, and to the lower one by lifting off two sections. The top section or cover is curved so as to assist the circulation of the hot air, and is provided with a self-baster—a perforated vessel in the top in which fat can be placed, which melting drips upon the joint below. A direct-reading temperature indicator is fixed on the top

FIG. 144.—"ELECTROYL" CONVECTOR IN THE ADAMS STYLE.

section, and by means of two switches three rates of heating are provided. It will be seen that the heating element is perfectly protected from falling moisture or fat, and from its position and shape it exposes the minimum surface to radiation sideways, while it is most effectively situated for radiation into the lower oven, and for radiation and convection into the upper one. The oven is made of tinned steel, light to handle and presenting bright external and internal surfaces, so that radiation losses are reduced to a minimum. It is made in three sizes, taking 800, 1,000 and 1,200 watts at full-load respectively, and the price is very low.

A similar arrangement is employed in the "Electroyl" patent steam cooker, based on a well-known system. This consists of a pair of sections like the lower pair in the oven, upon which are piled a series of steamers to almost any number, as shown. Directly the water in the boiler reaches boiling point, all the steamers are ready for use; on removing the boiling pan, the top of the section containing the heating element can be used for frying, grilling, &c., with ordinary utensils. The steam cooker is also made in three sizes, from 800 to 1,500 watts.

Turning to the heating apparatus, a complete set of "Electroyl" towel rails is shown; these are hollow, of solid drawn oval tube, and contain oil which is heated by a heating element in one of the vertical members, thus ensuring a good circulation of the fluid. There is also a great variety of "Electroyl" cooking apparatus, irons, convectors, &c., including a novel foot warmer and a fine example of a real Oriental brazier converted into an electric convector. In many of these apparatus the resistance heater for which

Messrs. Purcell & Nobbs hold the patents—wire interwoven with asbestos—is employed.

Some beautiful examples of art metal work are included in the exhibit, and in fig. 144 we illustrate one of these—an upright convector in the double ribbon Adams style.

Messrs. Gambrell Bros. (290),

Durham House, Clapham Common, S.W.

The exhibits on this stand include working models of various electrical instruments, specially arranged for lantern demonstrations; standard cells, resistances and condensers; "fool-proof" high sensitivity galvanometers of various types; galvanometer

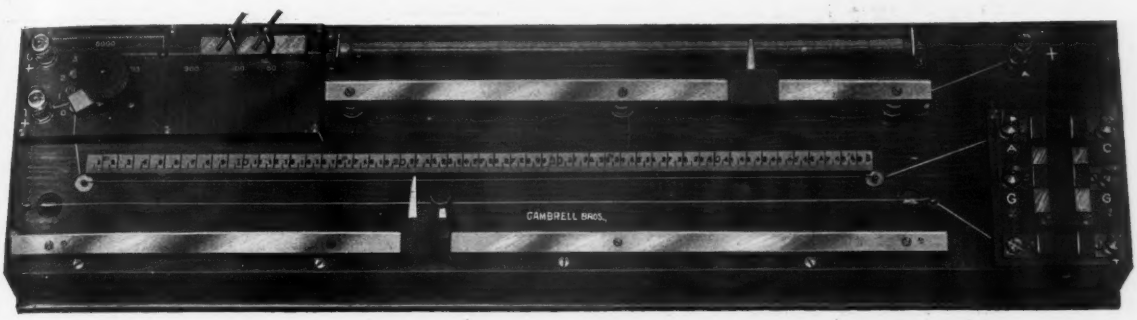


Fig. 145.—Gambrell Bros.' Thermo-electric Potentiometer.

scales and other accessories, and the following entirely new apparatus:—The high insulation testing key, illustrated in fig. 146, has a three-hole side spring as shown. This compels smart movement to the "charge" or "discharge" position, as the case may be, and then locks the key in this position with a firm contact pressure till the discharge or charge knob, respectively, is pressed or until, by the "Insulate" key, a flat plate is pressed down across the central portion of the switch arm, thus bringing this into the off position, where it is held by the central hole in the side spring. The thermo-electric potentiometer (Dr. L. Lownds), has only lately been perfected, and is now suitable for the measurement of any

Fig. 146.—High-insulation Testing Key.

small E.M.F., such as occur with thermo-elements. One mm. on the gilded manganin slide wire corresponds to two microvolts. The whole of the connections of the instrument are lined out on the top plate, and the terminals are lettered, so that no connecting diagram is required (see fig. 145). The working of the instrument is sensitive, accurate and very convenient. A moving-coil galvanometer exhibited presents no special features beyond its high sensibility, but this is extraordinary. The magnet pole-pieces are shaped to yield a uniform galvanometer scale.

Messrs. Gambrell Bros. are well-known manufacturers of every class of testing-room apparatus and accessories, and it is probable that before the close of the Exhibition, they will be showing a new type of wattmeter taking up to 1,000 amperes direct.

Globe Electric Co., Ltd. (120, 121),

11, *Farringdon Avenue, E.C.*

Lamps and instruments predominate at this stand; the well-known "Multax" flame arc lamps, in various patterns, the "Perl" enclosed arcs, and a variety of photographic arc lamps, &c., are shown, and we illustrate one of them (fig. 149), the "Perl" inverted

type, with a translucent reflector, which while throwing most of the light on the ceiling, allows sufficient light to pass directly downwards to prevent that too perfect shadowless diffusion which renders the outlines of objects indistinct, and gives an unnatural and flat effect. The instruments are of recent introduction under the name "Globe-Nadir," and the company claim that they combine low cost with an unusually high degree of accuracy. Fig. 148 shows the "Globe-Nadir" universal testing set, which possesses an extraordinarily wide range of utility; it is a voltmeter, ammeter, resistance bridge, insulation tester, fault localiser, and battery testing set, all in one.

Space does not allow of our explaining how the various combinations required to effect the above-mentioned measurements are carried out, but the switches and terminals are arranged so as to facilitate the operations; shunts are provided in the case for currents from ·05 to 60 amperes, and resistances for voltages from ·005 to 480, and with the battery contained in the instrument resistances can be measured up to 1 megohm. A slide-wire bridge is contained in the lid. With additional shunts and resistances, and a hand magneto or other external source of pressure, the above-mentioned ranges can be very greatly increased. An ingenious device embodied in the instrument is a small mirror mounted on a long arm, by which it can be brought under the pointer at any position on the scale when special accuracy is

Fig. 147.—Globe Electromagnetic Hammer.

desired; the mirror also carries an index by which the divisions of the scale can be further sub-divided, and the accuracy attained is guaranteed to within ± ·2 per cent.

Fig. 148.—Globe-Nadir Universal Testing Set.

Galvanometers of various types, pyrometers and moving-coil instruments for switchboards and of portable types are also shown.

One of the most interesting exhibits is the Globe electromagnetic hammer, an excellent substitute for the pneumatic hammer, which

we illustrate in fig. 147. This can be used for percussion drilling, caulking, chipping, riveting, &c., and is claimed to afford the solution to a problem of long standing. A little series motor

FIG. 149.—"PERL" INVERTED ARC LAMP.

drives the reciprocating mechanism, between which and the hammer element a magnetic cushion is interposed, eliminating shock and reducing vibration. The hammer element floats in a magnetic field inside a reciprocating sleeve, which is magnetised by a solenoid, and strikes 1,800 blows per minute; the whole thing weighs 25 lb., and is of handy shape, with a switch in the handle. The power consumed at full load is 220 watts, and the apparatus may be connected to an ordinary lampholder or socket. Ball bearings are used throughout, and the mechanism is enclosed in a strong metal casing. Other exhibits are the "Supra" brush-holder and brushes, and the "Glob-o-lite" illuminated sign, consisting of small glass balls held between metal plates, which are effective both by day and by night.

The special novelty about the Glob-o-lite sign is the method of holding the glass balls in position; they are cast with a flange or girdle round them, and are placed between two metal plates, perforated in accordance with the letter or device to be represented. The balls project through the apertures, but the girdle prevents them from falling out, and thus they are most securely fixed. The effect is excellent, and these signs require only a fraction of the illumination generally necessary.

Messrs. W. T. Henley's Telegraph Works Co., Ltd.

(178, 185),

Blomfield Street, London Wall, E.C.

An admirable and comprehensive exhibit has been arranged by this well-known firm. It includes insulated wires and cables in great variety, from the smallest silk-covered wires to specimens of the

FIG. 150.—HENLEY WIRING SYSTEM; MODE OF INSTALLATION.

largest cable used in a British battleship (3 in. in diameter over the armour, 2 sq. in. of copper, weighing in all 92,000 lb. per mile), and the largest ever supplied to a colliery (·8 sq. in., three-core, 3,000 volts, 4¼ in. in diameter and weighing 145,600 lb. per mile). In addition to these monsters there is a portion of the cable supplied to the Marconi Co. for the Clifden and Glace Bay stations—a two-core armoured cable of 0·02 sq. in., made for 40,000 volts, but tested to 130,000 volts for 10 minutes; this cable was paper-insu-

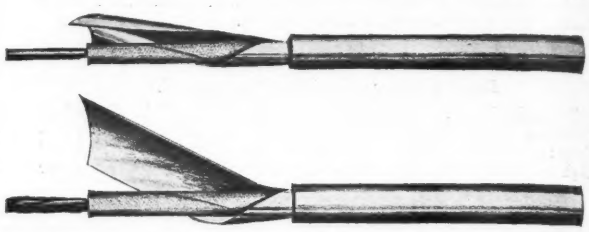


FIG. 151.—HENLEY WIRING SYSTEM: CONCENTRIC CABLES.

lated and lead-sheathed, and is used to carry direct current generated by Thury dynamos in series. Another interesting item is a three-phase loop-in feeder pillar, one of 150 supplied to the

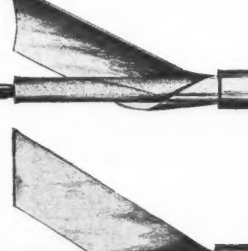


FIG. 152.—NORMAL PATTERN.

FIG. 153.—FOR BACK ENTRY.

BONDING CLAMPS FOR TWIN-WIRE SYSTEM.

Buenos Ayres and Pacific Railway; this is provided with a socket for an arc lamp-post on the top, and is made with a separate chamber for each phase, as shown in the section, fig. 154, each set of

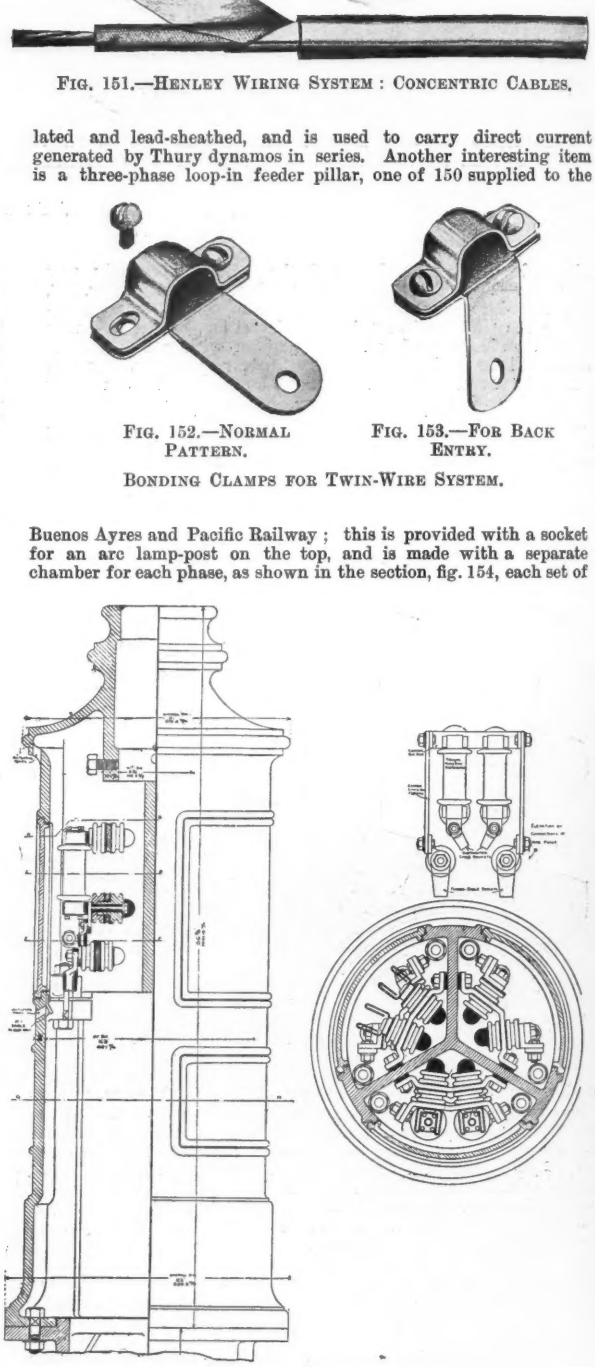


FIG. 154.—LOOP-IN FEEDER PILLAR, SECTIONS.

terminals providing for two distributors with fuses. Space for the arc lamp circuits is found below the high-pressure portion of the pillar.

Rubber driving belts and gloves, and a variety of trailing cables for coal-cutters, protected with hard-cord braid, leather, tarred marline, &c., as well as three-core flexible with hard-cord braiding for hand-lamps and portable tools, and diver's flexible four-core cable, with a tension centre, form noteworthy features of the exhibit, and demonstrations are given of the extraordinarily rapid action of ozone upon vulcanised rubber, which is, however, prevented by a special covering devised by Messrs. Henley's, and shown at the stand.

The Henley wiring system, which has just been brought out with a view to meeting the urgent demand for a simple, cheap and efficient method of wiring small installations, presents novel and ingenious features, which are illustrated herewith. The special wire used is of the concentric type with uninsulated outer; the inner conductor consists of 1/18, 3/22 or 3/20 wire, insulated with vulcanised rubber, and the outer of a tinned copper tape wound upon the core in a spiral with a long lay, the whole being sheathed with a solid-drawn tube of special alloy, which possesses a high degree of ductility, so that the cable can be bent sharply and straightened out again without injury. The three sizes made are shown in the accompanying fig. 151, and the method of wiring in fig. 150. The screw A, which is screwed into the wall or ceiling, is drilled and tapped, and the stud B is screwed into its head; the washer C is then slipped on, and is followed by the outer conductor D, in which a hole is punched for the purpose with a plier punch. A brass washer E and a spring washer F are then put on, and the nut G is screwed home. Lastly, the wood block is put in place and secured to the stud by the cone-shaped nut H.

Connection is made with the fitting by means of a short wire put on with the outer conductor, and a length of the inner conductor as shown. The whole thing is extremely simple, and the system can be used wherever an earthed outer is permissible. The cables are cleated to the walls with brass or lead saddles. Ordinary standard accessories are used with the system.

For use where the concentric system is barred, the company supply cables of the flat twin type, the insulation being of vulcanised rubber, sheathed with the special alloy above mentioned. These are used in the customary way, the only special fittings being

Fig. 155.—Candle-Bracket Fitting.

Albert C. Hands (2),

30, *Snow Hill, London, E.C.*

A useful collection of electric light pendants, brackets, candle fittings, and so forth, in various designs, styles and finishes, with glass and silk shades, are to be found on this stand, also electric radiators, Mr. Hands being a specialist in this department of the electrical trade. An artistic example of his candle-bracket fittings, and a luminous radiator, are shown in figs. 155 and 156 as representing the display.

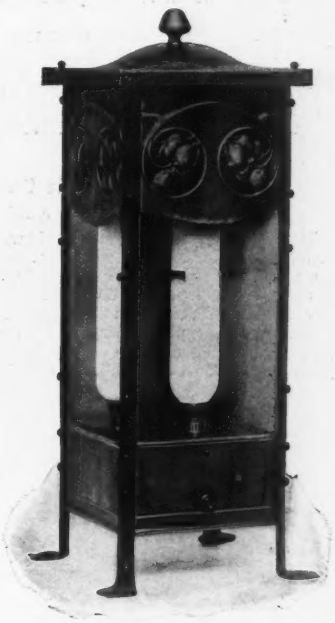


Fig. 156.—Hands Luminous Radiator.

Messrs. Evershed & Vignoles, Ltd. (168),

Acton Lane Works, Chiswick, W.

The beautiful instruments shown on this stand comprise examples of most of the company's well-known standard lines; they include meters of both moving-coil and moving-iron types, stationary and portable. One of our illustrations (fig. 158) shows a new three-range portable moving-iron ammeter for both A.C. and D.C., which needs no transformer, the change of range (to measure accurately from 1 to 100 amperes) being effected by means of a floating terminal of special design. The cell-testing voltmeter, which can be dropped without fear of damaging the pivots, has recently been described in our pages. Fig. 157 shows a recording voltmeter fitted with Murday's patent pen, which is carried on knife edges in a stirrup at the extremity of the hand, moving at right-angles to the motion of the paper. This ingenious device enables

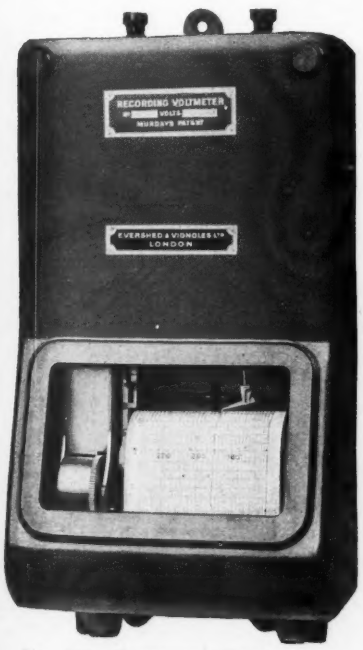


Fig. 157.—Evershed's Recording Voltmeter.

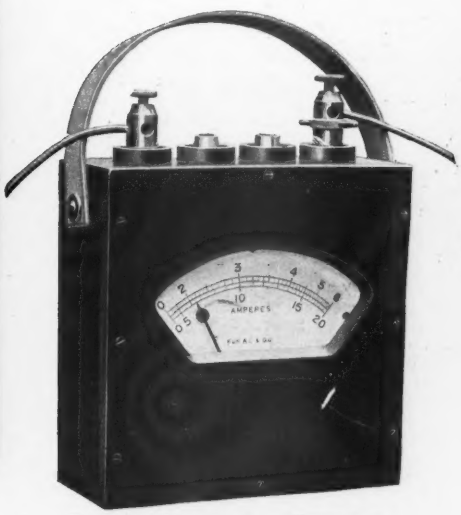


Fig. 158.—Three-range Portable Ammeter.

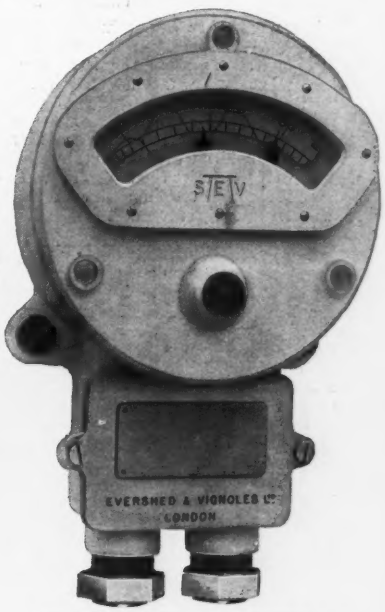


Fig. 159.—Admiralty Ampere Gauge.

the bonding clamp, fig. 152, which is nicked so that it can also be used for back entry, fig 153. Where the conditions necessitate further protection for the wiring, a light steel covering is fixed over the cables; this may also be used for appearances' sake where necessary.

The chief points claimed for the systems described are their low initial cost, low cost of installation, and extreme simplicity; and certainly all these claims appear to be fulfilled.

rectangular co-ordinates to be used on the chart instead of the usual curved ones, making the record easier to read.

Electrical speed indicators which indicate on a voltmeter are exhibited, as well as a patent electric soldering iron called the "Thermobit," which is readily connected to an ordinary lamp-holder.

The Admiralty pattern ampere gauge, illustrated in fig. 159, is of the moving-iron type, in a gun-metal case, and is water-tight and shock-proof; many other electrical instruments are made by the company for use on board ship, such as helm indicators, stoking indicators and telegraphs. The "Megger" and its associated instruments, such as the "Ducter" and the "Dionic" water tester are, of course, exhibited.

The Lazilite Co. (316),

Southampton House, High Holborn.

The accompanying illustrations show the "Lazilite" adjustable fitting at its full extension of 5 ft., and also totally closed: it is constructed of No. 14 gauge steel strip, and is strongly assembled. The great advantage gained over fittings of a movable kind is that any horizontal point can be reached within a circle of 10 ft. diameter, by simply moving the lamp by hand to the desired position, as the arm rotates through 360° about its point of suspension. Further, the light may be adjusted to any desired vertical position by means of a rise and fall pendant attached to the end of the arm. It is supplied in a standard finish of dull nickel; other finishes such as brass, oxidised silver, &c., can be supplied as desired. The fitting is manufactured by the Lazilite Co., who will be pleased to demonstrate its numerous advantages to our readers at their stand.

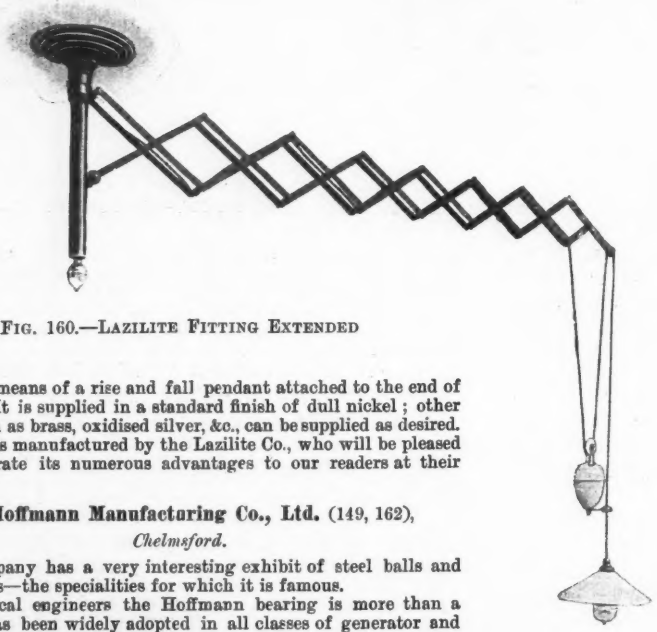


FIG. 160.—LAZILITE FITTING EXTENDED

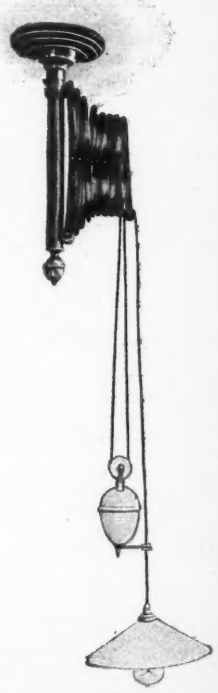


FIG. 161.—LAZILITE FITTING CLOSED.

The Hoffmann Manufacturing Co., Ltd. (149, 162),

Chelmsford.

This company has a very interesting exhibit of steel balls and ball bearings—the specialities for which it is famous.

To electrical engineers the Hoffmann bearing is more than a name; it has been widely adopted in all classes of generator and motor work, as may be gathered from the fine series of photographs of machines on which these bearings are being successfully used. Many of the leading makers have now standardised complete ranges of machines with these bearings, and visitors to the stand will do well to inspect the latter, as well as the firm's patent ball-bearing hanger in use on a line of shafting, for which purpose it has been signally successful.

Bi-Metals, Ltd. (324),

80A, *Southwark Street, S.E.*

The skilled workman, no less than the despairing amateur, will find a solution to all soldering difficulties in the well-known "Tinol" *paste-solder*. It is necessary to italicise these words since few persons can be brought to realise that "Tinol"—composed of practically pure tin and lead in conjunction with a certain oily flux—is in itself a complete soldering material and not merely a soldering paste. Visitors are being shown the efficacy of the composition by demonstrations on most unpromising materials, and by most unlikely methods. Dirty copper wires up to No. 18 S.W.G. are easily soldered by the smoky flame of a wooden match; hacksaws and malleable castings are thoroughly tinned by the mere application of "Tinol" and heat. Six compositions of the paste are available, and for certain purposes a core of "Tinol" is enclosed by a sheath of high grade solder. Besides the material itself, the exhibit includes a number of useful Tinol accessories and equipments.

"Rapid" Magnetting Co., Ltd. (10),

18, *The Crescent, Birmingham.*

This firm is exhibiting three types of electromagnetic separators excited by independent dynamos or the ordinary electric supply, as may be most convenient. The "Standard" machine is of the radial magnet drum type, and has an output (based on brass turnings), of 2 cwt. to 2 tons per day, according to size; this separator is especially suitable for materials containing a high percentage of iron, and repeat orders have been received from Government departments. Type "A" separator is a similar machine, except that the drum is now built up of alternate rings of iron and brass; it is designed for the removal of iron and steel from all kinds of large scrap and refuse. This type is now in use by the Birmingham and Glasgow Corporations, among others. Where material containing very little iron (whether in large pieces or minute particles) is to be treated, the type "BB" separator is most suitable. This is an inclined-tray machine, having a series of powerful electromagnetic bars of alternate polarity, extending the width of the shoot, and magnetised over their whole length: the separator is largely used for treating raw, ground or calcined bones, ground rubber, cotton seed, &c

Messrs. H. Wiggin & Co., Ltd. (247),

55, *George Street, Birmingham.*

This firm shows an interesting selection of its various electrical resistance materials. Besides the more ordinary German silver and copper-nickel materials, visitors should pay special attention to the "Tarnac" (copper-nickel-manganese), "Ferry" (copper-nickel), "Ferrozoid" (nickel-steel), and "nickel-chrome" grades of resistors. All these alloys are characterised by high strength, high specific resistance and low temperature coefficient of resistance. "Ferrozoid" has a tensile strength of 42·4 tons/sq. in., a temperature coefficient of resistance (per 1° C.) of 0·00076 and a specific resistance of 84 microhms/cm³. The corresponding figures for "nickel-chrome" are 47·1 tons/sq. in.; 0·00024 per 1° C.; 93·5 microhms/cm³. "Ferrozoid" has an extraordinarily low coefficient of expansion, viz., 0·00000706 per 1° C., but is subject to slight surface oxidation. Nickel-chrome, however, can be run at white heat for some time without damage.

The various resistance materials are shown as bare and covered wires, strips and stamped flexible grids; cotton, silk or asbestos covering is available. Attention may be called to the reels of No. 47 S.W.G. pure nickel wire and to the "Ferry" 6/14 stranded resistance cables as used by the Admiralty for searchlight work.

"Chicago Rawhide" Co., Ltd. (272),

Hythe Road, Willesden, N.W.

This firm makes an artistic exhibition of its various grades and sizes of heavy and light belts, laces, rope and twist. Rawhide blanks for gearing and "stripping," as used for protecting various underground cables, are shown, in addition to oak-tanned leather, hair, balata and cotton belts. Rawhide belting is specially supple, yet dense, owing to the avoidance of lime and acid processes in its manufacture; it is 40-60 per cent. lighter than the equivalent tanned belting, and can be built to four or more ply without serious loss of pliability.

Messrs. Braun & Co. (259),

King's Cross, London, N.

This exhibit includes a most interesting series of models ranging from a vacuum pump for cow milking to the model engines of the famous Rolls-Royce "Silver Ghost" and a tiny Helicopter aeroplane. All interested in the difficulties and accomplishments of model engineering should certainly visit this stand. We understand that nearly 3,000 inventions and models now pass annually through the King's Cross Works.

Messrs. W. H. Wilcox & Co., Ltd. (177, 186).

23, Southwark Street, London, S.E.

This firm is present with a representative and effective exhibit of the very wide variety of engineers' stores and engineering manufactures for which it is so well known. Among them will be observed lubricating oils, cylinder oils for high-speed engines for electrical installations, steam turbine and dynamo oils, all kinds of electrical installation stores; also engine and other packings, Penberthy patent injectors of several patterns for boiler feeding, Wilcox semi-rotary pumps, Wilcox-Turner triple-acting pumps, lubricators, beltings and driving bands, stocks and dies for electric conduits, electric drills and grinders, steam engine and boiler fittings, and so forth.

Messrs. C. W. Burton Griffiths & Co. (205, 210),

Ludgate Square, London, E.C.

A number of new machines are on view here. First there is a portable radial drilling machine, by Collet & Engelhard, with self-contained electric motor, suitable for drilling holes at almost any angle and in every position within reach of the radial arm. The machine is mounted on runner wheels, so as to be easily transported. An "M. C." gear-cutting machine is shown for working by the hobbing process, and especially intended for small gears of fine pitches, such as are found in the mechanism of electric meters, recorders, &c. The machine has a big output, and works at a high speed. Several sizes are made, and each can be arranged for spur gears only or for spur, worm and spiral gears. Other exhibits include a radial head automatic slot drilling machine for cutting slots or mortises in metal; a "Rice" patent high-speed ball-bearing sensitive drill, with three spindles and slow motion for tapping; a collection of small sensitive drilling and tapping machines for clock and instrument work; a "National" counting machine, a 6-in. "Acme" sawing machine, a Brown electric furnace and Brown pyrometer, grinding and milling machines, and various small tools.

Messrs. James Proctor, Ltd. (23, 38),

Burnley.

This exhibit consists of one of the firm's patent shovel stokers with moving firebars, which, as far as possible, mechanically imitates hand firing, also their patent coking stoker with self-cleaning firebars, which operates with a "ram" action, laying the coal well inside the furnace.

The rams are protected from burning by the charge of coal, and they are made with loose ends, which can be easily renewed.

A Proctor coal elevating and conveying plant is also shown, and attention may be directed to the "ram" feed fitted on the elevator boot, by means of which fuel is fed without friction or jamming into the moving elevator buckets, the usual plan being, of course, to feed the fuel direct into the boot through which the buckets are dragged.

The Unbreakable Pulley and Mill Gearing Co., Ltd. (25, 36),

West Gorton.

A complete range of the firm's specialities is exhibited, including bearings, couplings, pulleys, clutches, wall brackets, hangers, &c.

Among the bearings are the ingenious Skefko swivel type, also Cooper roller bearings, and Vickers patent type in which forced lubrication is obtained by a self-contained pump. The Reny patent flexible coupling may be mentioned as suitable for electrical uses, also the well-known Benn friction clutch, of which three types are shown, and which has met with very wide adoption in mill driving, &c., in sizes up to 1,000 H.P. The diminution of starting effort with modern frictionless bearings is impressed on the visitor by means of a testing machine on the stand.

Post Office Telegraphs and Telephones (283, 29, 32).

The Post Office Telegraphic exhibit at Olympia is in working order, and demonstrations are being given. Among the modern apparatus which is intended to illustrate the appliances at present in general use in the Post Office are the following:—The Wheatstone A.B.C. Apparatus, which is used chiefly at small country post offices where the assistants are unable to use the ordinary Morse instruments. This instrument will gradually be displaced by telephone apparatus. The double plate sounder shown is in reality an improved single needle instrument, but this apparatus has been abandoned by the Post Office, and is gradually being dispensed with generally, the sounder and telephone being looked upon as the standard instruments for the future. Double plate sounders are now chiefly to be found in railway telegraph offices. The single current sounder circuit is the simplest form of Morse circuit; it is useful for short circuits with a fair amount of traffic, and where the operators engaged are trained telegraphists. The double current duplex circuits system enables much longer distances to be worked over, owing to the rapid reversal of the currents in the line, and when a larger capacity is required from a circuit, the first step is to duplex the set. The Wheatstone automatic system is used when it is necessary to get a large quantity of work over a limited number of wires in a short space of time. The speed of this system may be anything up to 400 words a minute. The Wheatstone automatic system is that usually used for Press work, as the perforated slip can be used several times.

The Hughes type-printing apparatus and the fast repeater apparatus used in connection with the Wheatstone automatic system are shown. Specimens of modern telegraph and telephone cables, and a specimen in miniature (one-third actual size) of a telegraph line illustrating the method of construction and twisting wires to prevent inductance, are also exhibited.

Classified as ancient apparatus, the following are on view:—Wheatstone's four-needle instrument, which was used in 1838 Highton's single-needle instrument, 1848; double-needle instrument used at Buckingham Palace, 1851; Bright's bell, 1854; sounder and galvanometer combined, 1870; specimens of early forms of relays, electrometer, thermopile and the early Hughes type-printing telegraph; insulators used by Sir W. F. Cook, 1838-1847; Cooke and Wheatstone (Fossil) telegraph, 1837; early form of lead-covered cable laid at Chalk Farm, 1840; specimens of submarine cable, 1846; specimens of old pneumatic tube with carrier, 1854-1870; samples of incrustation of submarine cables and aerial wire; specimen of telegraph pole damaged by woodpeckers.

It was one of the first-mentioned of these "ancient" type instruments that was instrumental in securing the capture of the notorious Tawell, the Quaker murderer. The feat was not accomplished without difficulty; the instrument could not make the letter Q, and but for the ingenuity of the telegraphist, who spelt Quaker "Kwaker," the murderer would have escaped.

The Post Office has, in addition to the above, a separate telephone exhibit. This takes the form of a working telephone exchange, which will be known as the "Olympia" Exchange. It includes a switchboard of three working positions. The circuits of exhibitors at the Electrical Exhibition are connected with the switchboard, and subscribers obtain the same telephonic facilities from their stands as are afforded to subscribers to an ordinary telephone exchange. The equipment is of the latest common-battery type. The signalling between telephones in the stands and the switchboard is by means of miniature incandescent lamps fitted in the panels above the operator's keyboard. Connections are made by means of pairs of plugs and cords provided with lamp supervision. The accumulator battery at the rear of the stand provides energy for speech transmission and signalling; it is charged from the 220-volt direct-current supply through a voltage-regulating resistance comprised of 32-C.P. carbon-filament lamps fitted upon a power panel. The exhibit includes two strips of heat coils and lightning protectors (two heat coils and two protectors for each telephone circuit), two strips of line fuses (one pair to each telephone circuit), one bay of lamp-controlling relays, one bay of meters for recording calls made by subscribers, and other miscellaneous apparatus. Two demonstration telephones are also provided in order to show visitors more clearly the various steps taken in dealing with a telephone call.

Messrs. Marryat & Place (150),

28, Hatton Garden, E.C.

This firm have a stand in the centre of the Main Hall, where they have erected one of their latest pattern automatic electric lifts on a steel structure reaching to a height of 50 ft. They claim to have developed the automatic electric lift from the electrical side to the highest pitch, whilst profiting by the experience of others in mechanical details. The difficulty with push button lifts has been that with a brake of constant strength, the floor levelling varies according to the load; that is to say, when travelling with light load the car will stop a little above floor level, and when travelling with heavy load it will stop somewhat below floor level. This floor levelling error increases with the speed of the lift. To get over this difficulty, manufacturers have contrived various floor-finding switches fitted in the well.

Messrs. Marryat & Place's arrangement gets over the difficulty without the aid of any well switches, the whole apparatus being self-contained and fitted either at the top or bottom of the well, and they can run their lifts at three to four times the speeds previously possible with automatic control. The wiring and erecting costs are greatly reduced, and the whole apparatus is rendered extremely simple and reliable.

The lift exhibited is equipped with both push-button and car-switch control, together with a two-speed apparatus, the latter being a great convenience in places where it is sometimes required to operate the lift slowly for convenience of nervous or invalid people and at other times rapidly for general business.

Patent Castings Syndicate, Ltd. (273),

Balfour House, Finsbury Pavement, E.C.

This firm undertake every class of die casting; their success depends on the use of hard steel dies, and a wide range of patent alloys varying from soft Babbitt metals to specially hard, tough and non-corrodible materials. Wherever repetition work is concerned, parts can be turned out much cheaper than by machining. The cost of special machine tools is avoided, and absolute accuracy and interchangeability is guaranteed. The parts are suitable for use without machining or fitting, and the greater their complexity, the greater the saving over other methods of production. A large number of samples are exhibited, having various mechanical and electrical applications, and they deserve the careful attention of designers, works managers, and others.

Wandsworth Electrical Manufacturing Co., Ltd. (244A),

London and Birmingham.

This firm specialises in the smaller branches of house fittings such as tumbler switches, plugs, ceiling roses, fuse-boxes, &c.

As regards tumbler switches, the hundreds of decorative and plain patterns on view meet every requirement; we noticed a two-way tumbler switch with the base recessed, lead-covered cable, also a tumbler switch with a special master key handle, for use in corridors of large institutions, asylums, &c.; the attendant carries the key with him for switching on the lamps, and it cannot be withdrawn unless the switch is off and the lamps are out, thus preventing waste. We also noted a plug-box screwed for conduit wiring and a special two-way tumbler switch with an "off" position.

The small switches can be had with either circular or rectangular covers, and finished in either silver, bronze or copper, of Empire, Georgian or Adams styles as required. The firm have specialised in and largely developed the "flat" type of tumbler switch, which is very compact, and one of their manufacturers which has found considerable favour in the Far East is a tumbler switch with china cover and ebonite nob, and mounted on three feet, for use in damp situations.

Messrs. Siemens Bros. Dynamo Works, Ltd.

(179, 184, 206, 209),

Tyssen Street, Dalston, London, N.E.

Next week we shall allude to the variety of exhibits shown by this firm. We may now, however, call attention to their collection of electric light fittings in all types of finish and many-period designs. Fittings of the Adams, Jacobean, Elizabethan, Old Dutch and Georgian periods can be seen, with suitable glassware and tantalum and "Onewatt" lamps installed. Wall brackets, table lamps, electroliers and outside lanterns figure in large variety. There is also a fine selection of electric radiators, economic stoves and heaters, together with necessary accessories for use in conjunction with same. Naturally, the tantalum and "Onewatt" lamps figure conspicuously. There is a special range of low-voltage lamps (20-50-volt) made in 10 and 16-C.P. sizes, suitable for use with house transformers for economical private-house lighting; also a range of 50-C.P. lamps suitable for use on 100-130 and 200-250-volt circuits. These lamps can be obtained in either bell-shaped or spherical bulbs. A range of lamps from 100-600 C.P. have now been placed on the market, and it is hoped, before long, lamps up to 1,000 C.P. will be forthcoming. The tantalum lamp is made in a range of from 20-250 volts for candle-powers from 16-50. A mechanical device demonstrating the strength of the lamps is seen on Stand No. 209. It consists of two rotary arms, at each end of which are mounted tantalum and "Onewatt" lamps respectively. These are set in motion and rotated by means of an electric motor, which accounts for a certain amount of vibration, and owing to the speed at which they revolve, the centrifugal force, acting upon the hot filament, is sufficient to break the more fragile type of lamps. As our readers are aware, a practical demonstration of the great strength of these lamps can be seen on some of the underground tube railways, such as the Great Northern and City, where they are installed in the trains. We understand that groups of tantalum lamps have given a life of over 5,000 hours when subjected to tube railway car vibration.

"Onewatt" battery lamps for motor-car headlights are also being exhibited, and sample showcards are displayed which contain one of each type of "Onewatt" battery lamp at present supplied by Messrs. Siemens Bros. Dynamo Works, Ltd. A variety of carbon-filament lamps are exhibited in a show-case, which has a revolving wheel mounted at the back driven by an electric motor. On each spoke of the wheel is a different type of lamp (all under current), and this is revolved at a rapid speed. These lamps are the carbon-filament traction type with anchored filaments. Carbon-filament lamps for collieries, photographic purposes, private house and general purposes, are also present. With regard to glassware, a wide selection of fancy glass shades in satin etched and opalescent finish, and a number of cut-glass shades, are exhibited. Holophane glassware suitable for use in conjunction with tantalum and "Onewatt" lamps can be seen, and demonstrations will be given to anybody interested. The new "Household" type of Holophane reflectors, which are designed primarily to combine an efficient distribution of light with artistic effect, may also be seen, and are in actual use on some of the fittings on the stand.

August Reichwald (256),

Exchange Buildings, Newcastle-on-Tyne.

"Festonit" and "Festo-Bakelite" insulating material for the electrical trade is here shown in various shapes and forms. It is supplied in sheets and plates for cutting up into any required sizes, and also for switchboards, distributing boards, electricity meter boards and baseboards. Motor terminal boxes, hand lamps, switch handles, bushes, arc shields for controllers, are all made of "Festonit," and "Festonit"-covered bolts, &c., for overhead tramway work form one of the firm's specialities. "Festonit" can be moulded and machined.

"Festonit" and "Festo-Bakelite" are claimed to be of high insulating value, great dielectric and mechanical strength, to resist heat and cold. "Festonit" plates of 8 mm. to 10 mm. thickness compare favourably in price with slate or marble of 25 mm. thickness.

Besides the plain plates for switchboards and distributing boards, &c., there are made special plates for these purposes with thickened rims, which, although having the appearance and strength of thick marble or slate, are reduced in weight and price to meet the competition of slate or marble, irrespective of the other advantages which are derived from using "Festonit" and "Festo-Bakelite."

Metalite, Ltd. (176, 187),

London and Derby.

The woman in white who first catches your fancy on this stand bears upwards a number of "Metalite" metal-filament lamps, one of 100 C.P., and four of 200 C.P., being placed either vertically or at angles, which are regarded as testing their ability to burn in any position. Along the sides for the lighting of the stand there are a number of 50 and 32-C.P. "Metalites."

The Electric Home.

In the Model Electric Home Messrs. John Barker & Co., Ltd., of Kensington, S.W., have prepared an exhibit which both does them credit and forms a great attraction to the public, whether they are interested in the more technical exhibits or not. The "Home" is to be found in the gallery just over the ELECTRICAL REVIEW's stand at the farther end of the building. The building is in French Renaissance style, and of the decorative work and furnishing we need say little here. Of course, the visitor can observe how electricity can be employed for everything, lighting, cooking, heating, pumping, and so forth. In the words of the official description, the lighting of the drawing room is "by means of electric lamps coyly hidden in the coves," and everywhere the electrical details make a very attractive appeal to the visitor and impress him or her more than any other exhibit in the building with the easy adaptability of electricity to every class of operation to which the housewife and the domestic are accustomed in the twentieth century home. While it is, no doubt, true that many of those who have passed, or will pass, through these rooms cannot afford to change their ways over to the completely electrical in their existing or even new homes, there have been or will be others who can, and doubtless will, do so as the result of what is to be seen here. And those who cannot adopt electricity throughout will no doubt be so impressed that they will go as far as they can and use it to a limited extent at first. The Home has its own generating plant, consisting of a 4-B.H.P. paraffin engine (2·5-KW.) coupled to a 50/75-volt dynamo. There is also a 50-volt 27-cell battery capable of maintaining 125 16-C.P. metallic-filament lamps for seven hours on one charge. This "power house" supplies the necessary energy for the electric heating irons in the laundry, the cooking stoves in the kitchen, the electric light bath, massage instruments, electric fans, radiators, electric irons, and the lighting throughout the dining, drawing and bedroom and hall, also for working the small pump used in the garden, and for rendering necessary services in the garage. From the general public point of view we regard this exhibit as being one of the utmost interest, as experience has proved such features to be at other electrical exhibitions.

Messrs. John Barker & Co., Ltd. (280),

Kensington, W.

The well-known Kennedy bending machine and specimens of its work are on view. This machine will, in its various sizes, bend tubes from ¼ in. diameter up to 2 in. diameter to radii from 1¼ in. to 8 in. Moreover, the tubes are bent cold and unloaded, even though they be of the open joint type. Various patterns of the machine are arranged for power drive or hand operation by various means. Top and bottom and side blocks completely prevent distortion of the work during bending, various sizes and shapes of the central former being used according to the nature of the work handled. Visitors can see and test the machine in actual working, and the many edge-bent strips, S-bent angle irons, and so on, are striking examples of the excellent results obtainable. A special machine has been introduced for cold-bending round or square bars—from ⅜ in. rod on ¾ in. radius up to 1½ in. rod on 1 in. radius—for reinforced concrete work.

The Stern-Sonneborn Oil Co., Ltd. (28, 33),

Royal London House, Finsbury Square, E.C.

This company has, as the central feature of its stand, and one which will undoubtedly interest power station engineers, an exhibit of an oil-testing machine, of which we may be able to publish descriptive particulars later. The company's "Sternol" transformer, turbine, high-tension, switch and brake, and other electrical and engineering oils, also "Sternoline" motor grease for electrical machinery, bearing grease, commutator paste, and other similar specialities are, of course, well in evidence.

Various Exhibits.

MESSRS. WINSTON & CO. (294) are exhibiting a selection of general optical goods, including small microscopes, combination achromatic lenses and ophthalmometers, besides a useful range of clinical and dairy thermometers and various types of spirit levels.

THE ACME LADDER CO. (301) exhibit a number of extension ladders and similar appliances for use in trimming and cleaning electric lamps, replacing fuses, and, in fact, performing any "overground" work.

TAYLOR'S "quick-grip" spanners (Gallery stand 302) are exhibited, and are applicable to any nut or fastening over a wide range of sizes. A special cone spanner acts also as a wire-cutter and wire-grip, and has specially shallow jaws.

Combination knife and tool sharpeners, files and magnetic screwdrivers are being shown, together with other engineering tools, by the DIAMOND STEEL CO. (258), E. KRONEY & CO. (285), and the EXCELSIOR TRADING CO. (305).

Lacquers.—THE FREDERICK CRANE CHEMICAL CO., of 22 and 23, Newhall Hill, Birmingham, make a speciality of suitable lacquers for tools. The lacquers may be applied by dipping, brushing or spraying. Spraying machines may be seen in operation at the company's works.

NOTES.

(*Continued from page* 554.)

Fatal Tramway Accident.—On Monday morning a young man named Wm. Knight died at Birmingham General Hospital as the result of a tramway accident which took place late on Sunday night at Smethwick, by which 12 persons were injured. A car from the city was proceeding up Cape Hill, Smethwick, when something went wrong. The car began to run back, and the driver not being able to check it, it dashed into another one which was following about 50 yd. behind. The force of the impact was so great that both cars were driven down the steep decline and came into collision with a third standing at the bottom. Knight was a passenger in the second car, and the chief injuries were sustained by passengers in this car. With the exception of Knight and a Mrs. Davis, who was also seriously injured, all the other passengers were able to proceed home. The driver of the second car escaped death by jumping off.

Associated Municipal Electrical Engineers (Greater London).—At the last meeting, the Association elected the following officers :—

President : W. C. P. Tapper, Stepney.
Vice-Presidents : F. A. Bond, Battersea ; L. L. Robinson, Hackney ; A. H. Shaw, Ilford.
Hon. Treasurer : G. G. Bell, Hammersmith.
Hon. Auditors : J. G. Bruce, Willesden ; E. Calvert, Finchley.
Hon. Secretary : Norman Staniland, Hornsey.
Council : S. W. Baynes, St. Pancras ; J. H. Bowden, Poplar ; H. H. Couzens, West Ham ; C. S. Davidson, Barnes ; A. J. Fuller, Fulham ; F. Hill, Hammersmith ; W. Innes, Poplar ; C. Newton Russell, Shoreditch ; P. E. Rycroft, Heston ; E. Sayer, Hampstead ; A. H. Seabrook, St. Marylebone ; W. C. Ullmann, East Ham.

Owing to the kind permission of the Institution of Electrical Engineers, the Association meetings are now held at the new Institution buildings, and the dates of the meetings will be fixed in advance. The Association had under consideration at its meeting various matters of interest, including the question of a defensive combination between the power and light authorities (including gas companies) in times of general strikes. The Association visited the Electrical Exhibition at Olympia on October 4th.

Educational Notes.—Borough Polytechnic Institute.—We have received the prospectus for the new session, which gives particulars of the various courses, including evening classes in electrical and mechanical engineering, motor-car engineering, &c. Dr. J. Henderson is head of the Electrotechnics Department. The session began on September 25th.

Institution Notes.—Institution of Electrical Engineers (Students' Section).—The hon. sec., Mr. D. Batts, 3, Fordwych Road, London, N.W., wishes to call the attention of those members of the Students' Section who desire to read papers to the fact that it is necessary that notice of such intention be sent to him immediately, in order that the announcement of such intention may be embodied in the programme of the session, which is now being drawn up.

The G.E.C. Athletic Club.—The G.E.C. Athletic Club opened their football season on Saturday last on their new ground at Willesden with a stirring game between Head Office (Osram F.C.) and Queenhithe Branch (Magnet F.C.). The game was very fast on account of the boisterous wind which was blowing from end to end, the ball being very hard to control. A hard fought game resulted in a win for the "Osram" team by 3 goals to 2. The secretary will be pleased to hear from any club connected with the industry with a view to fixing up matches for the coming season.

Appointments Vacant.—Day lecturer in engineering mathematics at the Northampton Polytechnic Institute (£120 per session). Second engineer-in-charge for the Ilford U.D.C. Electricity Works (£120). See our advertisement pages to-day.

The Evolution of Wiring Systems.—In the article on p. 556, which went to press early in the week, the cost of installation per lamp in No. 10 should read 13s., not 12s.

Smoke Abatement Exhibition.—The Manchester and Salford Smoke Abatement Exhibition will be held in the City Hall, Liverpool Road, Manchester, from November 10th to 25th. We understand that everything points to the event being a success.

Inquiry.—Makers of the "Eclipse" arc lamp are asked for.

Institute of Metals.—The autumn meeting was held at Newcastle-on-Tyne last week. A report will appear in our next issue.

At the Church Congress.—Sir R. Hardy, speaking at Hanley, on Tuesday, on the peace question, said, "The machinery at the Hague was a splendid engine, provided there was a dynamo to drive it." (*As reported in the Westminster Gazette.*)

Electrolytic Zinc.—It is stated in the *Board of Trade Journal* that a method for the electrolytic refining of zinc has been invented by Mr. Chitaru Yoshida, proprietor of the Kano Copper Mine, Iwashiro Province, Japan. This new process will, it is stated, enable zinc to be refined in Japan, which hitherto has not been commercially possible. Up to the present zinc ore has been exported, and the refined metal imported. The process is being patented, and the right of working it in Japan has been leased to the Mitsui Bussan Kaisha.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Brighton T.C. on September 28th rejected, by 37 votes to 11, a motion to increase the salary of Mr. C. C. Fowler, assistant manager of the electricity works, from £350 to £375 per annum, rising to £400 a year hence. By 27 votes to 13 it was also decided not to adopt a proposal that the salary of Mr. G. T. Joyce, chief clerk, be increased from £250 to £300 per annum, but the salary of Mr. T. Henwood, mains superintendent, was increased from £3 10s. to £3 15s. per week, and that of Mr. W. Charman, meter inspector, from £2 2s. to £2 5s. per week.

At the Electricity Works, Factory Lane, Croydon, last Saturday afternoon, Mr. A. C. Cramb, the borough electrical engineer, was, on the occasion of his approaching marriage, made the recipient of a present from the staff and employés of the Corporation Electricity Department. The present took the form of a large silver salver suitably inscribed. Mr. W. Burr, deputy borough electrical engineer, made the presentation, wishing Mr. Cramb, on behalf of the staff and employés, the best of health and happiness. Mr. Cramb suitably responded, acknowledging the good feeling which prompted the gift, and expressing his appreciation.

On Friday, September 29th, the staff and workmen of the Pontypridd Urban District Council's Electricity Department presented Mr. E. C. Gaccon, charge engineer, with a marble timepiece to celebrate the occasion of his marriage. The presentation was made by Mr. J. E. Teasdel, engineer and manager.

Tramway Officials.—Mr. Arthur J. Hardy has resigned his position with the Engineer-in-Chief's Department of the General Post Office, London, to take up an appointment as secretary of the Malta Electrical Tramways.

General.—Amongst those who have been awarded the Edward Medal, Second Class, for bravery in rescue work at the Pretoria Pit, Hulton disaster last December, is Mr. James H. Polley, electrician at the Hulton Collieries.

Mr. W. C. Field, who was formerly with Messrs. Harry Cox and Co., has joined the Bryant Trading Syndicate, Ltd.

The marriage has taken place at Los Angeles, California, of Mr. F. G. Garstang, electrician, formerly of Blackburn, to Miss Margaret A. Kenna, also of Blackburn.

Mr. Fred Farrar, until recently in the Electrical Engineering Department of Blackburn Technical School, has been appointed demonstrator and lecturer in Electric Wiring at Fleetwood Technical School.

On leaving the British Thomson-Houston Co., Ltd., of Rugby, to take up an appointment with the British Westinghouse Co., at Manchester, Mr. W. H. Wood was presented by the staff with a marble clock.

Obituary.—We regret to learn that Mr. Wm. Shuter, late chairman of the Telegraph Construction and Maintenance Co., Ltd., passed away on Tuesday, October 3rd, at Hampstead, N.W., at the age of 82 years.

NEW COMPANIES REGISTERED.

Ormskirk Electric Supply Co., Ltd. (117,854).—This company was registered on September 29th with a capital of £8,000 in £1 shares, to acquire and take a transfer of, and all benefit and rights under the Ormskirk Electric Lighting Order, 1900, to adopt an agreement with the Ormskirk Urban District Council, and to carry on business of suppliers of electricity for light, heat, motive power or force, &c. The subscribers (with 1,000 shares each) are :—Rhodes Motors, Ltd. (A. L. Rhodes and R. Salem, directors), 90, Charing Cross Road, W.C. ; A. L. Rhodes, Armthorpe, Doncaster, electrical engineer ; J. W. Speight, The Elms, St. Annes-on-the-Sea, electrical engineer. Private company. The provisional directors are A. L. Rhodes, R. Salem and J. W. Speight. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

London Electric Treatment Co. (1911), Ltd. (117,852).—This company was registered on September 29th, with a capital of £100 in £1 shares, to take over the business of an electric light cure and electro-therapeutic institute carried on by the London Electric Treatment Institute, Ltd., at 43 and 44, New Bond Street, W., and to adopt agreements with E. E. Greville and E. W. B. Wright. The subscribers (with one share each) are :—L. Dick, 15, Dover Street, W., motor hiring agent ; P. C. Brocas-Parsons, 28, Sackville Street, W., engineer. Private company. E. W. B. Wright is the first managing director. Registered office, 43 and 44, New Bond Street, W.

Messrs. W. H. Wilcox & Co., Ltd. (177, 186).

23, Southwark Street, London, S.E.

This firm is present with a representative and effective exhibit of the very wide variety of engineers' stores and engineering manufactures for which it is so well known. Among them will be observed lubricating oils, cylinder oils for high-speed engines for electrical installations, steam turbine and dynamo oils, all kinds of electrical installation stores; also engine and other packings, Penberthy patent injectors of several patterns for boiler feeding, Wilcox semi-rotary pumps, Wilcox-Turner triple-acting pumps, lubricators, beltings and driving bands, stocks and dies for electric conduits, electric drills and grinders, steam engine and boiler fittings, and so forth.

Messrs. C. W. Burton Griffiths & Co. (205, 210),

Ludgate Square, London, E.C.

A number of new machines are on view here. First there is a portable radial drilling machine, by Collet & Engelhard, with self-contained electric motor, suitable for drilling holes at almost any angle and in every position within reach of the radial arm. The machine is mounted on runner wheels, so as to be easily transported. An "M. C." gear-cutting machine is shown for working by the hobbing process, and especially intended for small gears of fine pitches, such as are found in the mechanism of electric meters, recorders, &c. The machine has a big output, and works at a high speed. Several sizes are made, and each can be arranged for spur gears only or for spur, worm and spiral gears. Other exhibits include a radial head automatic slot drilling machine for cutting slots or mortises in metal; a "Rice" patent high-speed ball-bearing sensitive drill, with three spindles and slow motion for tapping; a collection of small sensitive drilling and tapping machines for clock and instrument work; a "National" counting machine, a 6-in. "Acme" sawing machine, a Brown electric furnace and Brown pyrometer, grinding and milling machines, and various small tools.

Messrs. James Proctor, Ltd. (23, 38),

Burnley.

This exhibit consists of one of the firm's patent shovel stokers with moving firebars, which, as far as possible, mechanically imitates hand firing, also their patent coking stoker with self-cleaning firebars, which operates with a "ram" action, laying the coal well inside the furnace.

The rams are protected from burning by the charge of coal, and they are made with loose ends, which can be easily renewed.

A Proctor coal elevating and conveying plant is also shown, and attention may be directed to the "ram" feed fitted on the elevator boot, by means of which fuel is fed without friction or jamming into the moving elevator buckets, the usual plan being, of course, to feed the fuel direct into the boot through which the buckets are dragged.

The Unbreakable Pulley and Mill Gearing Co., Ltd. (25, 36),

West Gorton.

A complete range of the firm's specialities is exhibited, including bearings, couplings, pulleys, clutches, wall brackets, hangers, &c.

Among the bearings are the ingenious Skefko swivel type, also Cooper roller bearings, and Vickers patent type in which forced lubrication is obtained by a self-contained pump. The Reny patent flexible coupling may be mentioned as suitable for electrical uses, also the well-known Benn friction clutch, of which three types are shown, and which has met with very wide adoption in mill driving, &c., in sizes up to 1,000 H.P. The diminution of starting effort with modern frictionless bearings is impressed on the visitor by means of a testing machine on the stand.

Post Office Telegraphs and Telephones (283, 29, 32).

The Post Office Telegraphic exhibit at Olympia is in working order, and demonstrations are being given. Among the modern apparatus which is intended to illustrate the appliances at present in general use in the Post Office are the following:—The Wheatstone A.B.C. Apparatus, which is used chiefly at small country post offices where the assistants are unable to use the ordinary Morse instruments. This instrument will gradually be displaced by telephone apparatus. The double plate sounder shown is in reality an improved single needle instrument, but this apparatus has been abandoned by the Post Office, and is gradually being dispensed with generally, the sounder and telephone being looked upon as the standard instruments for the future. Double plate sounders are now chiefly to be found in railway telegraph offices. The single current sounder circuit is the simplest form of Morse circuit; it is useful for short circuits with a fair amount of traffic, and where the operators engaged are trained telegraphists. The double current duplex circuits system enables much longer distances to be worked over, owing to the rapid reversal of the currents in the line, and when a larger capacity is required from a circuit, the first step is to duplex the set. The Wheatstone automatic system is used when it is necessary to get a large quantity of work over a limited number of wires in a short space of time. The speed of this system may be anything up to 400 words a minute. The Wheatstone automatic system is that usually used for Press work, as the perforated slip can be used several times.

The Hughes type-printing apparatus and the fast repeater apparatus used in connection with the Wheatstone automatic system are shown. Specimens of modern telegraph and telephone cables, and a specimen in miniature (one-third actual size) of a telegraph line illustrating the method of construction and twisting wires to prevent inductance, are also exhibited.

Classified as ancient apparatus, the following are on view:—Wheatstone's four-needle instrument, which was used in 1838 Highton's single-needle instrument, 1848; double-needle instrument used at Buckingham Palace, 1851; Bright's bell, 1854; sounder and galvanometer combined, 1870; specimens of early forms of relays, electrometer, thermopile and the early Hughes type-printing telegraph; insulators used by Sir W. F. Cook, 1838-1847; Cooke and Wheatstone (Fossil) telegraph, 1837; early form of lead-covered cable laid at Chalk Farm, 1840; specimens of submarine cable, 1846; specimens of old pneumatic tube with carrier, 1854-1870; samples of incrustation of submarine cables and aerial wire; specimen of telegraph pole damaged by woodpeckers.

It was one of the first-mentioned of these "ancient" type instruments that was instrumental in securing the capture of the notorious Tawell, the Quaker murderer. The feat was not accomplished without difficulty; the instrument could not make the letter Q, and but for the ingenuity of the telegraphist, who spelt Quaker "Kwaker," the murderer would have escaped.

The Post Office has, in addition to the above, a separate telephone exhibit. This takes the form of a working telephone exchange, which will be known as the "Olympia" Exchange. It includes a switchboard of three working positions. The circuits of exhibitors at the Electrical Exhibition are connected with the switchboard, and subscribers obtain the same telephonic facilities from their stands as are afforded to subscribers to an ordinary telephone exchange. The equipment is of the latest common-battery type. The signalling between telephones in the stands and the switchboard is by means of miniature incandescent lamps fitted in the panels above the operator's keyboard. Connections are made by means of pairs of plugs and cords provided with lamp supervision. The accumulator battery at the rear of the stand provides energy for speech transmission and signalling; it is charged from the 220-volt direct-current supply through a voltage-regulating resistance comprised of 32-C.P. carbon-filament lamps fitted upon a power panel. The exhibit includes two strips of heat coils and lightning protectors (two heat coils and two protectors for each telephone circuit), two strips of line fuses (one pair to each telephone circuit), one bay of lamp-controlling relays, one bay of meters for recording calls made by subscribers, and other miscellaneous apparatus. Two demonstration telephones are also provided in order to show visitors more clearly the various steps taken in dealing with a telephone call.

Messrs. Marryat & Place (150),

28, Hatton Garden, E.C.

This firm have a stand in the centre of the Main Hall, where they have erected one of their latest pattern automatic electric lifts on a steel structure reaching to a height of 50 ft. They claim to have developed the automatic electric lift from the electrical side to the highest pitch, whilst profiting by the experience of others in mechanical details. The difficulty with push button lifts has been that with a brake of constant strength, the floor levelling varies according to the load; that is to say, when travelling with light load the car will stop a little above floor level, and when travelling with heavy load it will stop somewhat below floor level. This floor levelling error increases with the speed of the lift. To get over this difficulty, manufacturers have contrived various floor-finding switches fitted in the well.

Messrs. Marryat & Place's arrangement gets over the difficulty without the aid of any well switches, the whole apparatus being self-contained and fitted either at the top or bottom of the well, and they can run their lifts at three to four times the speeds previously possible with automatic control. The wiring and erecting costs are greatly reduced, and the whole apparatus is rendered extremely simple and reliable.

The lift exhibited is equipped with both push-button and car-switch control, together with a two-speed apparatus, the latter being a great convenience in places where it is sometimes required to operate the lift slowly for convenience of nervous or invalid people and at other times rapidly for general business.

Patent Castings Syndicate, Ltd. (273),

Balfour House, Finsbury Pavement, E.C.

This firm undertake every class of die casting; their success depends on the use of hard steel dies, and a wide range of patent alloys varying from soft Babbitt metals to specially hard, tough and non-corrodible materials. Wherever repetition work is concerned, parts can be turned out much cheaper than by machining. The cost of special machine tools is avoided, and absolute accuracy and interchangeability is guaranteed. The parts are suitable for use without machining or fitting, and the greater their complexity, the greater the saving over other methods of production. A large number of samples are exhibited, having various mechanical and electrical applications, and they deserve the careful attention of designers, works managers, and others.

Wandsworth Electrical Manufacturing Co., Ltd. (244A),

London and Birmingham.

This firm specialises in the smaller branches of house fittings such as tumbler switches, plugs, ceiling roses, fuse-boxes, &c.

As regards tumbler switches, the hundreds of decorative and plain patterns on view meet every requirement; we noticed a two-way tumbler switch with the base recessed, lead-covered cable, also a tumbler switch with a special master key handle, for use in corridors of large institutions, asylums, &c.; the attendant carries the key with him for switching on the lamps, and it cannot be withdrawn unless the switch is off and the lamps are out, thus preventing waste. We also noted a plug-box screwed for conduit wiring and a special two-way tumbler switch with an "off" position.

The small switches can be had with either circular or rectangular covers, and finished in either silver, bronze or copper, of Empire, Georgian or Adams styles as required. The firm have specialised in and largely developed the "flat" type of tumbler switch, which is very compact, and one of their manufacturers which has found considerable favour in the Far East is a tumbler switch with china cover and ebonite nob, and mounted on three feet, for use in damp situations.

Messrs. Siemens Bros. Dynamo Works, Ltd.

(179, 184, 206, 209),

Tyssen Street, Dalston, London, N.E.

Next week we shall allude to the variety of exhibits shown by this firm. We may now, however, call attention to their collection of electric light fittings in all types of finish and many-period designs. Fittings of the Adams, Jacobean, Elizabethan, Old Dutch and Georgian periods can be seen, with suitable glassware and tantalum and "Onewatt" lamps installed. Wall brackets, table lamps, electroliers and outside lanterns figure in large variety. There is also a fine selection of electric radiators, economic stoves and heaters, together with necessary accessories for use in conjunction with same. Naturally, the tantalum and "Onewatt" lamps figure conspicuously. There is a special range of low-voltage lamps (20-50-volt) made in 10 and 16-C.P. sizes, suitable for use with house transformers for economical private-house lighting; also a range of 50-C.P. lamps suitable for use on 100-130 and 200-250-volt circuits. These lamps can be obtained in either bell-shaped or spherical bulbs. A range of lamps from 100-600 C.P. have now been placed on the market, and it is hoped, before long, lamps up to 1,000 C.P. will be forthcoming. The tantalum lamp is made in a range of from 20-250 volts for candle-powers from 16-50. A mechanical device demonstrating the strength of the lamps is seen on Stand No. 209. It consists of two rotary arms, at each end of which are mounted tantalum and "Onewatt" lamps respectively. These are set in motion and rotated by means of an electric motor, which accounts for a certain amount of vibration, and owing to the speed at which they revolve, the centrifugal force, acting upon the hot filament, is sufficient to break the more fragile type of lamps. As our readers are aware, a practical demonstration of the great strength of these lamps can be seen on some of the underground tube railways, such as the Great Northern and City, where they are installed in the trains. We understand that groups of tantalum lamps have given a life of over 5,000 hours when subjected to tube railway car vibration.

"Onewatt" battery lamps for motor-car headlights are also being exhibited, and sample showcards are displayed which contain one of each type of "Onewatt" battery lamp at present supplied by Messrs. Siemens Bros. Dynamo Works, Ltd. A variety of carbon-filament lamps are exhibited in a show-case, which has a revolving wheel mounted at the back driven by an electric motor. On each spoke of the wheel is a different type of lamp (all under current), and this is revolved at a rapid speed. These lamps are the carbon-filament traction type with anchored filaments. Carbon-filament lamps for collieries, photographic purposes, private house and general purposes, are also present. With regard to glassware, a wide selection of fancy glass shades in satin etched and opalescent finish, and a number of cut-glass shades, are exhibited. Holophane glassware suitable for use in conjunction with tantalum and "Onewatt" lamps can be seen, and demonstrations will be given to anybody interested. The new "Household" type of Holophane reflectors, which are designed primarily to combine an efficient distribution of light with artistic effect, may also be seen, and are in actual use on some of the fittings on the stand.

August Reichwald (256),

Exchange Buildings, Newcastle-on-Tyne.

"Festonit" and "Festo-Bakelite" insulating material for the electrical trade is here shown in various shapes and forms. It is supplied in sheets and plates for cutting up into any required sizes, and also for switchboards, distributing boards, electricity meter boards and baseboards. Motor terminal boxes, hand lamps, switch handles, bushes, arc shields for controllers, are all made of "Festonit," and "Festonit"-covered bolts, &c., for overhead tramway work form one of the firm's specialities. "Festonit" can be moulded and machined.

"Festonit" and "Festo-Bakelite" are claimed to be of high insulating value, great dielectric and mechanical strength, to resist heat and cold. "Festonit" plates of 8 mm. to 10 mm. thickness compare favourably in price with slate or marble of 25 mm. thickness.

Besides the plain plates for switchboards and distributing boards, &c., there are made special plates for these purposes with thickened rims, which, although having the appearance and strength of thick marble or slate, are reduced in weight and price to meet the competition of slate or marble, irrespective of the other advantages which are derived from using "Festonit" and "Festo-Bakelite."

Metalite, Ltd. (176, 187),

London and Derby.

The woman in white who first catches your fancy on this stand bears upwards a number of "Metalite" metal-filament lamps, one of 100 C.P., and four of 200 C.P., being placed either vertically or at angles, which are regarded as testing their ability to burn in any position. Along the sides for the lighting of the stand there are a number of 50 and 32-C.P. "Metalites."

The Electric Home.

In the Model Electric Home Messrs. John Barker & Co., Ltd., of Kensington, S.W., have prepared an exhibit which both does them credit and forms a great attraction to the public, whether they are interested in the more technical exhibits or not. The "Home" is to be found in the gallery just over the ELECTRICAL REVIEW's stand at the farther end of the building. The building is in French Renaissance style, and of the decorative work and furnishing we need say little here. Of course, the visitor can observe how electricity can be employed for everything, lighting, cooking, heating, pumping, and so forth. In the words of the official description, the lighting of the drawing room is "by means of electric lamps coyly hidden in the coves," and everywhere the electrical details make a very attractive appeal to the visitor and impress him or her more than any other exhibit in the building with the easy adaptability of electricity to every class of operation to which the housewife and the domestic are accustomed in the twentieth century home. While it is, no doubt, true that many of those who have passed, or will pass, through these rooms cannot afford to change their ways over to the completely electrical in their existing or even new homes, there have been or will be others who can, and doubtless will, do so as the result of what is to be seen here. And those who cannot adopt electricity throughout will no doubt be so impressed that they will go as far as they can and use it to a limited extent at first. The Home has its own generating plant, consisting of a 4-B.H.P. paraffin engine (2·5-KW.) coupled to a 50/75-volt dynamo. There is also a 50-volt 27-cell battery capable of maintaining 125 16-C.P. metallic-filament lamps for seven hours on one charge. This "power house" supplies the necessary energy for the electric heating irons in the laundry, the cooking stoves in the kitchen, the electric light bath, massage instruments, electric fans, radiators, electric irons, and the lighting throughout the dining, drawing and bedroom and hall, also for working the small pump used in the garden, and for rendering necessary services in the garage. From the general public point of view we regard this exhibit as being one of the utmost interest, as experience has proved such features to be at other electrical exhibitions.

Messrs. John Barker & Co., Ltd. (280),

Kensington, W.

The well-known Kennedy bending machine and specimens of its work are on view. This machine will, in its various sizes, bend tubes from $\frac{1}{8}$ in. diameter up to 2 in. diameter to radii from $1\frac{1}{2}$ in. to 8 in. Moreover, the tubes are bent cold and unloaded, even though they be of the open joint type. Various patterns of the machine are arranged for power drive or hand operation by various means. Top and bottom and side blocks completely prevent distortion of the work during bending, various sizes and shapes of the central former being used according to the nature of the work handled. Visitors can see and test the machine in actual working, and the many edge-bent strips, S-bent angle irons, and so on, are striking examples of the excellent results obtainable. A special machine has been introduced for cold-bending round or square bars—from $\frac{5}{8}$ in. rod on $\frac{1}{2}$ in. radius up to $1\frac{1}{2}$ in. rod on 1 in. radius—for reinforced concrete work.

The Stern-Sonneborn Oil Co., Ltd. (28, 33),

Royal London House, Finsbury Square, E.C.

This company has, as the central feature of its stand, and one which will undoubtedly interest power station engineers, an exhibit of an oil-testing machine, of which we may be able to publish descriptive particulars later. The company's "Sternol" transformer, turbine, high-tension, switch and brake, and other electrical and engineering oils, also "Sternoline" motor grease for electrical machinery, bearing grease, commutator paste, and other similar specialities are, of course, well in evidence.

Various Exhibits.

MESSRS. WINSTON & CO. (294) are exhibiting a selection of general optical goods, including small microscopes, combination achromatic lenses and ophthalmometers, besides a useful range of clinical and dairy thermometers and various types of spirit levels.

THE ACME LADDER CO. (301) exhibit a number of extension ladders and similar appliances for use in trimming and cleaning electric lamps, replacing fuses, and, in fact, performing any "overground" work.

TAYLOR'S "quick-grip" spanners (Gallery stand 302) are exhibited, and are applicable to any nut or fastening over a wide range of sizes. A special cone spanner acts also as a wire-cutter and wire-grip, and has specially shallow jaws.

Combination knife and tool sharpeners, files and magnetic screwdrivers are being shown, together with other engineering tools, by the DIAMOND STEEL CO. (258), E. KRONEY & CO. (285), and the EXCELSIOR TRADING CO. (305).

Lacquers.—THE FREDERICK CRANE CHEMICAL CO., of 22 and 23, Newhall Hill, Birmingham, make a speciality of suitable lacquers for tools. The lacquers may be applied by dipping, brushing or spraying. Spraying machines may be seen in operation at the company's works.

NOTES.

(*Continued from page* 554.)

Fatal Tramway Accident.—On Monday morning a young man named Wm. Knight died at Birmingham General Hospital as the result of a tramway accident which took place late on Sunday night at Smethwick, by which 12 persons were injured. A car from the city was proceeding up Cape Hill, Smethwick, when something went wrong. The car began to run back, and the driver not being able to check it, it dashed into another one which was following about 50 yd. behind. The force of the impact was so great that both cars were driven down the steep decline and came into collision with a third standing at the bottom. Knight was a passenger in the second car, and the chief injuries were sustained by passengers in this car. With the exception of Knight and a Mrs. Davis, who was also seriously injured, all the other passengers were able to proceed home. The driver of the second car escaped death by jumping off.

Associated Municipal Electrical Engineers (Greater London).—At the last meeting, the Association elected the following officers:—

President: W. C. P. Tapper, Stepney.
Vice-Presidents: F. A. Bond, Battersea; L. L. Robinson, Hackney; A. H. Shaw, Ilford.
Hon. Treasurer: G. G. Bell, Hammersmith.
Hon. Auditors: J. G. Bruce, Willesden; E. Calvert, Finchley.
Hon. Secretary: Norman Staniland, Hornsey.
Council: S. W. Baynes, St. Pancras; J. H. Bowden, Poplar; H. H. Couzens, West Ham; C. S. Davidson, Barnes; A. J. Fuller, Fulham; F. Hill, Hammersmith; W. Innes, Poplar; C. Newton Russell, Shoreditch; P. E. Rycroft, Heston; E. Sayer, Hampstead; A. H. Seabrook, St. Marylebone; W. C. Ullmann, East Ham.

Owing to the kind permission of the Institution of Electrical Engineers, the Association meetings are now held at the new Institution buildings, and the dates of the meetings will be fixed in advance. The Association had under consideration at its meeting various matters of interest, including the question of a defensive combination between the power and light authorities (including gas companies) in times of general strikes. The Association visited the Electrical Exhibition at Olympia on October 4th.

Educational Notes.—Borough Polytechnic Institute.—We have received the prospectus for the new session, which gives particulars of the various courses, including evening classes in electrical and mechanical engineering, motor-car engineering, &c. Dr. J. Henderson is head of the Electrotechnics Department. The session began on September 25th.

Institution Notes.—Institution of Electrical Engineers (Students' Section).—The hon. sec., Mr. D. Batts, 3, Fordwych Road, London, N.W., wishes to call the attention of those members of the Students' Section who desire to read papers to the fact that it is necessary that notice of such intention be sent to him immediately, in order that the announcement of such intention may be embodied in the programme of the session, which is now being drawn up.

The G.E.C. Athletic Club.—The G.E.C. Athletic Club opened their football season on Saturday last on their new ground at Willesden with a stirring game between Head Office (Osram F.C.) and Queenhithe Branch (Magnet F.C.). The game was very fast on account of the boisterous wind which was blowing from end to end, the ball being very hard to control. A hard fought game resulted in a win for the "Osram" team by 3 goals to 2. The secretary will be pleased to hear from any club connected with the industry with a view to fixing up matches for the coming season.

Appointments Vacant.—Day lecturer in engineering mathematics at the Northampton Polytechnic Institute (£120 per session). Second engineer-in-charge for the Ilford U.D.C. Electricity Works (£120). See our advertisement pages to-day.

The Evolution of Wiring Systems.—In the article on p. 556, which went to press early in the week, the cost of installation per lamp in No. 10 should read 13s., not 12s.

Smoke Abatement Exhibition.—The Manchester and Salford Smoke Abatement Exhibition will be held in the City Hall, Liverpool Road, Manchester, from November 10th to 25th. We understand that everything points to the event being a success.

Inquiry.—Makers of the "Eclipse" arc lamp are asked for.

Institute of Metals.—The autumn meeting was held at Newcastle-on-Tyne last week. A report will appear in our next issue.

At the Church Congress.—Sir R. Hardy, speaking at Hanley, on Tuesday, on the peace question, said, "The machinery at the Hague was a splendid engine, provided there was a dynamo to drive it." (*As reported in the Westminster Gazette.*)

Electrolytic Zinc.—It is stated in the *Board of Trade Journal* that a method for the electrolytic refining of zinc has been invented by Mr. Chitaru Yoshida, proprietor of the Kano Copper Mine, Iwashiro Province, Japan. This new process will, it is stated, enable zinc to be refined in Japan, which hitherto has not been commercially possible. Up to the present zinc ore has been exported, and the refined metal imported. The process is being patented, and the right of working it in Japan has been leased to the Mitsui Bussan Kaisha.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Brighton T.C. on September 28th rejected, by 37 votes to 11, a motion to increase the salary of Mr. C. C. Fowler, assistant manager of the electricity works, from £350 to £375 per annum, rising to £400 a year hence. By 27 votes to 13 it was also decided not to adopt a proposal that the salary of Mr. G. T. Joyce, chief clerk, be increased from £250 to £300 per annum, but the salary of Mr. T. Henwood, mains superintendent, was increased from £3 10s. to £3 15s. per week, and that of Mr. W. Charman, meter inspector, from £2 2s. to £2 5s. per week.

At the Electricity Works, Factory Lane, Croydon, last Saturday afternoon, Mr. A. C. Cramb, the borough electrical engineer, was, on the occasion of his approaching marriage, made the recipient of a present from the staff and employés of the Corporation Electricity Department. The present took the form of a large silver salver suitably inscribed. Mr. W. Burr, deputy borough electrical engineer, made the presentation, wishing Mr. Cramb, on behalf of the staff and employés, the best of health and happiness. Mr. Cramb suitably responded, acknowledging the good feeling which prompted the gift, and expressing his appreciation.

On Friday, September 29th, the staff and workmen of the Pontypridd Urban District Council's Electricity Department presented Mr. E. C. Gaccon, charge engineer, with a marble timepiece to celebrate the occasion of his marriage. The presentation was made by Mr. J. E. Teasdel, engineer and manager.

Tramway Officials.—Mr. Arthur J. Hardy has resigned his position with the Engineer-in-Chief's Department of the General Post Office, London, to take up an appointment as secretary of the Malta Electrical Tramways.

General.—Amongst those who have been awarded the Edward Medal, Second Class, for bravery in rescue work at the Pretoria Pit, Hulton disaster last December, is Mr. James H. Polley, electrician at the Hulton Collieries.

Mr. W. C. Field, who was formerly with Messrs. Harry Cox and Co., has joined the Bryant Trading Syndicate, Ltd.

The marriage has taken place at Los Angeles, California, of Mr. F. G. Garstang, electrician, formerly of Blackburn, to Miss Margaret A. Kenna, also of Blackburn.

Mr. Fred Farrar, until recently in the Electrical Engineering Department of Blackburn Technical School, has been appointed demonstrator and lecturer in Electric Wiring at Fleetwood Technical School.

On leaving the British Thomson-Houston Co., Ltd., of Rugby, to take up an appointment with the British Westinghouse Co., at Manchester, Mr. W. H. Wood was presented by the staff with a marble clock.

Obituary.—We regret to learn that Mr. Wm. Shuter, late chairman of the Telegraph Construction and Maintenance Co., Ltd., passed away on Tuesday, October 3rd, at Hampstead, N.W., at the age of 82 years.

NEW COMPANIES REGISTERED.

Ormskirk Electric Supply Co., Ltd. (117,854).—This company was registered on September 29th with a capital of £3,000 in £1 shares, to acquire and take a transfer of, and all benefit and rights under the Ormskirk Electric Lighting Order, 1900, to adopt an agreement with the Ormskirk Urban District Council, and to carry on business of suppliers of electricity for light, heat, motive power or force, &c. The subscribers (with 1,000 shares each) are:—Rhodes Motors, Ltd. (A. L. Rhodes and R. Salem, directors), 90, Charing Cross Road, W.C.; A. L. Rhodes, Armthorpe, Doncaster, electrical engineer; J. W. Speight, The Elms, St. Annes-on-the-Sea, electrical engineer. Private company. The provisional directors are A. L. Rhodes, R. Salem and J. W. Speight. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

London Electric Treatment Co. (1911), Ltd. (117,852).—This company was registered on September 29th, with a capital of £100 in £1 shares, to take over the business of an electric light cure and electro-therapeutic institute carried on by the London Electric Treatment Institute, Ltd., at 43 and 44, New Bond Street, W., and to adopt agreements with E. E. Greville and E. W. B. Wright. The subscribers (with one share each) are:—L. Dick, 16, Dover Street, W., motor hiring agent; P. C. Brocas-Parsons, 28, Sackville Street, W., engineer. Private company. E. W. B. Wright is the first managing director. Registered office, 43 and 44, New Bond Street, W.

Clevedon and District Electric Supply Co., Ltd. (117,847).—This company was registered on September 29th, with a capital of £12,000 in £1 shares, to carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in cables, wires, lines, accumulators, lamps, &c., and to adopt an agreement with Christy Bros. & Co., Ltd. The subscribers are:—F. W. Taylor, Highfield, Chelmsford, auctioneer, 100 shares; G. Wilks, 17, Duke Street, Chelmsford, auctioneer, 1 share; F. Ward, 40, Broomfield Road, Chelmsford, solicitor, 1 share; L. F. Christy, 51, Broomfield Road, Chelmsford, electrical engineer, 100 shares; C. E. Smith, 7, Park Road, Chelmsford, electrical engineer, 1 share; A. A. Gates, 20, Glebe Road, Chelmsford, clerk, 1 share; F. Christy, 53, Broomfield Road, Chelmsford, electrical engineer, 100 shares. Minimum cash subscription, 6,000 shares. The number of directors is not to be less than three or more than seven; the first are F. W. Taylor, L. F. Christy and F. Christy; qualification, 100 shares; remuneration as fixed by the company. Registered by Duffield and Son, Chelmsford.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hydraulic Power and Smelting Co., Ltd. (117,141).—Particulars of £1,000,000 debentures, created August 29th, and secured by trust deed dated September 4th, 1911, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £875,000. Property charged: 5,000 "Bearer" shares of the Aktieselskabet Tysssefaldene of 500 kroner each; 5,000 "Bearer" shares of £100 each in the Norsk Elektrisk Metalinsurtri Aktieselskab and 6,000 registered shares of 100 kroner each in the Trollhattans Elektrollhaus Electrothermiska, Aktiebolag, and the company's undertaking and property, present and future, including uncalled capital, but excluding specifically mortgaged premises. Trustees: Rt. Hon. Earl of Kintore, P.C., G.C.M.G., Keith Hall, Inverie, N.B.; and Sir Walter F. Hely-Hutchinson, G.C.M.G., 147, St. James Court, S.W.

Aron Electricity Meter, Ltd. (58,650).—Return dated July 4th, filed July 27th, 1911; capital, £350,000 in £1 shares (125,000 preference); 125,000 ordinary and 124,896 preference shares taken up; £1 per share called up on 124,896 preference; £124,948 10s. paid, including £52 10s. on 104 preference shares forfeited; £125,000 considered as paid on 125,000 ordinary shares. Mortgages and charges: £104,900

Beck Flame Lamp, Ltd. (92,387).—Particulars of £2,000 second mortgage debenture stock, created September 4th, 1911, and secured by trust deed dated September 20th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Leasehold premises at Hayes, Middlesex, subject to prior charge, certain British and Colonial patents, and the company's undertaking and property, including uncalled capital. Trustees: C. de Broe, Walden Lodge, Carlisle Road, Eastbourne; and F. W. Biddle, 22, Aldermanbury, E.C.

Corona Lamp Works, Ltd. (116,527).—Issue on September 13th, 1911, of £200 debentures, part of a series of which particulars have already been filed.

Sloan Electrical Co., Ltd. (61,528).—Return dated July 29th, filed August 3rd, 1911. Capital, £15,000 in £1 shares (5,000 "A" preference and 10,000 ordinary). 5,000 "A" preference and 2,754 ordinary shares taken up. £1 per share called up on 1,254 ordinary. £1,254 paid. £6,500 considered as paid on 5,000 "A" preference and 1,500 ordinary. Mortgages and charges: Nil.

Stearn Electric Lamp Co., Ltd. (95,340).—Return dated August 8th, filed August 9th, 1911. Capital, £4,070 in £10 shares. 407 shares taken up. £10 per share called up on 7. £70 paid. £4,000 considered as paid on 400 shares. Mortgages and charges: Nil.

St. Austell and District Electric Lighting and Power Co., Ltd. (66,382).—Return dated August 21st, filed September 7th, 1911. Capital, £10,000 in £1 shares (3,000 preference). 3,000 preference and 4,887 ordinary taken up. £1 per share called up. £7,887 paid. Mortgages and charges: £4,000.

Trowbridge Electric Supply Co., Ltd. (114,745).—Mortgage dated September 21st, 1911, to secure £250, charged on land in Duke Street, Trowbridge, with the buildings erected thereon. Holder: J. H. Blake, Beechfield, Melksham.

Electrical Power Storage Co., Ltd. (30,313C).—Return dated August 3rd, filed August 12th, 1911. Capital, £100,500 in £5 shares (100 founders'). 66 founders' and 18,892 ordinary shares taken up. £5 per share called up on 66 founders', and £4 per share on 3,132 ordinary. £13,332 5s. 1d. paid. £77,300 considered as paid on 15,460 shares. £474 5s. 1d. on 5 founders' and 405 ordinary shares forfeited. Mortgages and charges: £10,000.

CITY NOTES.

Anglo-American Telegraph Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Friday last week at Winchester House, Old Broad Street, E.C., for the purpose of considering resolutions for the transfer of the company to the Western Union Telegraph Co.

Mr. F. A. Bevan, the chairman who presided, proposed resolutions authorising the directors to carry into effect the provisional agreement already entered into with the Western Union Co. He said the agreement had been so fully discussed in the Press that even before reading the circular, which all the shareholders had received informing them of its principal points, they were probably pretty well aware of its nature, and therefore he did not propose to occupy much of their time. He would first like to allude to the reasons which led the directors to enter into the agreement. He need hardly say that the proposals for the agreement came from the other side. They would have been quite satisfied to continue to work under the pool agreement between the three companies—themselves, the Direct United States Co., and the Western Union, but the gentlemen who had the management of the Western Union were of opinion that if the three companies could be brought under one management, instead of being, as hitherto, under three separate managements, it would be easier to effect improvements which they had in contemplation in working the telegraphs, and that it would also save expense. With that object the negotiations for the agreement were commenced, and when they had made considerable progress the Western Union made the discovery that the pooling agreement under which they had been working so satisfactorily as far as the Anglo-American Co. was concerned for many years, was in contravention of the Sherman Trust Act. Shortly speaking, that Act aimed at preventing combinations of companies entering into monopolies, which would have a detrimental effect upon the general public in America. Of course, they over here were no judges of what the Sherman Act really was, and therefore they thought it right to consult the best legal opinion they could get from the other side, and they invited over one of the most eminent lawyers in the United States, and he (the chairman) was bound to say that he was a gentleman of remarkable acumen and experience, and they had every reason to believe that the advice which he gave them was thoroughly sound. He told them that the matter could not be absolutely settled without going to a court of law, but that he had no doubt in his mind that if it was brought before the Courts they would declare the pooling agreement illegal. He thought the shareholders would agree that the directors were bound to act upon the advice which they had received. Whether they would have done better to have gone into a legal fight he could not say. The case would have taken a very long time and cost a lot of money, during which time, no doubt, the shareholders would have received considerably less in the way of dividend. The directors thought that the better way, instead of contesting the matter, was to assume that the advice they had received was correct. The Western Union Co. at once stated that believing the advice to be correct, they would terminate the pooling agreement as from March 1st last, which meant that instead of the earnings being divided as they had been up to that time in certain proportions between the three companies, each company would do its best to get traffic and would only be entitled to the earnings which it could make. Therefore they would have had to depend more or less upon their own unaided work, which was a totally different thing from having the traffic pooled as hitherto. It must be borne in mind that there was a slight advantage to the Americans as compared with themselves—the traffic from America was far larger than the traffic to America; but in addition to that the Western Union Co. had an enormous inland business on the other side and, therefore, it was only natural that they would be able to get hold of the traffic on that side in a way that they on this side could not possibly do. That, therefore, in the directors' opinion was a strong additional reason why they should enter into the agreement which they proposed to the shareholders. What might have been the issue if they had gone into a fight, he could not say, but he, personally, and his colleagues agreed with him, was of opinion that under the agreement they were safer than they would have been if they had gone into a regular stand-up fight with their former colleagues and friends, which they did not wish to do. Those were the principal reasons why the directors had thought fit to submit the agreement, and why they strongly advised them to approve it. The lease was one for 99 years, and it guaranteed 3¾ per cent. on their ordinary stock, which meant 6 per cent. on the preferred and 1½ per cent. on the deferred, an amount which they had only once exceeded since 1884—that was since they had had the present tariff. If they took that 3¾ per cent. on 7 millions, it seemed to him that it was a very good return, because if they looked at the market price of their stock, it was somewhere about 4½ millions, and, therefore, 3¾ per cent. on 7 millions represented a much higher rate of interest than 3¾ per cent. on the market price of the stock. In addition, the Western Union Co. had to maintain their cables and all their plant; they had also to keep up their renewal fund till it reached a million, just as it was under the previous arrangement. They took over all their liabilities and they relieved them of the management of the cable, but on the other hand, they had purchased from them the cable which they had laid down a few months ago. The cost of that would come out of their renewal fund, which would therefore be diminished by a very large amount, and the Western Union Co. would have to contribute for many years a considerable sum if they were going to make it up to a million, as they were bound to do. As to the number of cables, the Western Union, under the agreement, were bound to maintain five, except in the case of the failure of one of their old cables. If they then substituted for two of their cables a new cable equal in power to the two, then they were to maintain four cables, including the one they, the Anglo-American Co., had just purchased from them. Therefore there would never be less than four cables. Their plant was to be maintained, and their dividend guaranteed whatever happened, and they had only to sit down and receive their dividends. There were certain contingencies under which the lease might be determined. On their side if the Western Union were to fail to pay this guaranteed dividend, they could give them notice to terminate the contract. On the other hand, if by the action of either the British Government or the United States Government, it was found practically impossible to carry on the traffic, then the Western Union Co. would be released from their obligations. It appeared to him that those contingencies were most unlikely when they thought of the magnitude of the Western Union Co.; after paying its debentures it had an earning power of something like one million of money, and over and above the dividend which it paid to its shareholders there remained a very large surplus. Taking these facts into consideration, and the further point that the traffic itself was from natural causes likely to increase, he should say that the 3¾ per cent. was about as safe as it possibly could be, and the deferred shareholders, instead of having what he might term a speculative stock, would have really a gilt-edged stock which would not be subject to fluctuations, and they would know exactly where they were. It had been hinted in the papers that some difficulties might arise. It had been suggested that the new agreement was a violation of the Sherman Trust Act. He need not tell them that they had taken counsel's opinion upon

that point, and they were assured, as far as they could tell, that the agreement was not in violation of the Trust Act. It seemed to him (the chairman) that there was this difference—that instead of there being, as there was now, a combination of the three companies to maintain certain rates, none of which could be altered without the consent of all the companies, it would now be in the power of the Western Union to vary the rate as and when they pleased. They could put the rates up or down as they pleased, but they would have to pay them their 3½ per cent. He knew it was dangerous to prophesy, but as far as he knew, he saw no reason why the agreement should not last the 99 years. If, from any unforeseen contingency, it came to an end, the position of the Anglo-American Co. would be that they would resume with their four or five cables maintained; they would have all their plant that was not perishable handed back to them; they would have their renewal fund at whatever point it might have reached, and they had the assurance that the Western Union Co. would do their utmost to restore them, as far as traffic was concerned, to the position which they occupied before making the agreement. He thought they would agree that the directors had, in every way that was possible, safeguarded the interests of the shareholders, and in recommending them to approve the agreement, he believed they were doing that which was safest for the interests of the shareholders.

Sir Gerald Fitzgerald seconded the resolution.

In reply to Mr. Chester, a shareholder, Mr. Carson, the general manager, said that the traffic was pretty equally divided between east and west; the greater proportion—about 52 per cent.—came from America and about 48 per cent. came from this side.

The Chairman, in reply to questions, said it was the intention of the directors to pay dividends quarterly in the future. In expending their money on a new cable, they were in no way damaging themselves. They were getting a very fine new cable, and in any case, sooner or later, they would have had to lay a new cable. The position would be, that they would have five cables in addition to the Western Union two, and they would be their property, although they would be leased to the Western Union. Therefore, in the event of the agreement breaking down, they would be in a very much better position, having this new cable already laid, than if they had the money.

Mr. Carslake, the solicitor, replying to further questions, said that as to the power of the company to enforce its rights under the contract, the contract was an English one, and they could sue the Western Union Co. here as well as in America. They could get judgment against them here and put in a Receiver of all their receipts on this side. Then, again, if the Western Union broke the lease, they could determine it and retake possession of their property. In the event of the Sherman Act being put into force, and the lease being declared invalid, there again they would have all their property back, and the lease contained a proviso that the Western Union Co. were, in that event, to give the company the same facilities in the United States for the transmission of their traffic on the overland lines that they enjoyed at the end of 1910.

The resolutions were then carried unanimously, and the proceedings terminated with a vote of thanks to the chairman and directors.

Direct United States Cable Co., Ltd.

The sixty-eighth ordinary general meeting of the shareholders of the above company was held on Friday last week at Winchester House, Old Broad Street, E.C., Mr. E. M. Underdown, K.C., in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 479), and the confirmation of the dividend already paid, said that the outstanding feature of the accounts was the decrease of £13,326 in the half-year's receipts, which, as explained in the report, was due to the Western Union Co. having ceased since March 1st last, to hand over to them or to the Anglo-American Co., the proportion of the eastward traffic, which up to that time since the year 1882 had always been dealt with by them. The increase of £2,471 in the working expenses was entirely due to the establishment of the Harbor Grace station consequent on the diversion of the cable to Newfoundland, which had resulted in an acceleration of the speed at which messages were transmitted from the cables, equal to some 70 per cent. upon its previous record. The reason for the delay in holding the meeting, was that in the middle of July when the accounts were usually circulated, they were entering upon the final stage of the protracted negotiations which had resulted in the agreement with the Western Union Co., and it was, therefore, deemed inadvisable to publish the accounts at that time. Those negotiations had now been brought to a conclusion, and if the agreement was approved by the shareholders, the Western Union would have to hand over to them the sum of £10,800 in respect of the traffic withheld since March 1st, so that the diminution in their income would be practically covered. From a diplomatic point of view, it was thought desirable to continue the dividend as usual up to June last, and having regard to their reserve fund having been increased by £18,000 in the half-year, the directors felt themselves justified in using some £7,000 of that increase for the purpose of the dividend. The directors were fully alive to the strength of the position of the company, and they were confident that the Western Union Co. would concede terms that would be regarded as satisfactory by the shareholders.

Sir J. Pender, Bt., seconded the motion, and the report was adopted.

An extraordinary general meeting was then held for the purpose of considering an agreement to lease the cables of the company to the Western Union Telegraph Co.

The Chairman, in proposing a resolution approving of the agreement, said that the shareholders were probably all aware that since 1882 the company had been working with the Anglo-American Telegraph Co. and the Western Union Co. under agreements entered into with a view not only to secure and maintain the successful carrying on of their cable business, but also to give to the public an efficient cable service between this country and the United States and Canada, founded upon the mutual support and facilities between the cables for all purposes, it being conceded that there was a necessity for a fair number of lines across the Atlantic if steady communication was to be secured. Under that arrangement the bulk of the cable business was, up to 1882, conducted over the cables of the Anglo and Direct Companies; the Anglo possessing four cables to their one, it would be obvious that the proportion of traffic dealt with by them was small as compared with that dealt with by the Anglo Co. In 1882 the Western Union Co. joined the combination with two cables, while the landlines and communications on the other side were conducted by the Western Union. In order that they might properly appreciate the position of the Western Union Co. in America he must explain that it was a company possessing, in addition to cables across the Atlantic, an independent telegraph system in many respects comparable with that of the telegraph system in this country, which was in the hands of the Government. The Western Union Co. did not have a monopoly of the telegraph system in America, but its only serious competitor was the Postal Telegraph Co., an ally of the Commercial Cable Co. In the year 1910 the Western Union Co. had 24,825 offices in the United States, operating 1,429,049 miles of wire and 214,360 miles of poles and cables. The total receipts for 1910 amounted to the huge sum of $33,889,202, equal to nearly 7 million pounds sterling, and after paying all expenses, interest and dividends for the year a balance of revenue remained of $2,597,373, or over £500,000. Those figures would give them some idea of the magnitude of the Western Union Co.'s operations, and he had no doubt would satisfy them that the payment of the rental for their cables was well secured. Although the Anglo-American and their company had hitherto maintained separate offices in New York and other centres, under the working arrangement that existed between the three companies, the Western Union Co. acted in America, to all intents and purposes, as collectors of cable messages passing over the cables of the three companies, and these messages were distributed and dealt with in agreed proportions. In the early part of 1910 a controlling interest in the Western Union Co. was obtained by the American Telegraph and Telephone Co., and a change in the management of the former company followed. About the same time, the United States Government proceeded to put in force the Sherman Anti-Trust Act, which prohibited combinations characterised as being in restraint of trade, and in view of this, the Western Union Co. was advised that the agreement then existing between the three companies involved a contravention of the Sherman Act, and that the only method of avoiding it was to enter into some fresh agreement which would do away with the objectionable features of the combination. In May, 1910, negotiations were commenced with the Anglo and the Direct Companies to this end, and certain proposals were submitted to them which they, in the interests of the shareholders, were reluctantly compelled to decline. That was the position of affairs when, in February last, the Western Union gave notice that, in view of the agreement being considered as a violation of the provisions of the Sherman Act, the agreement that had been in existence between the three companies since 1882 would no longer be recognised. In the meantime they had obtained the highest legal advice in America and on this side, and they at once intimated to the Western Union Co. that they could not accept that notice, but that they would hold them to the 1882 agreement. The Western Union Co., therefore, gave notice cancelling the convention. The advisers of the Western Union Co. were satisfied that the proposed lease was not a contravention of the Act. It must be admitted that their advisers were not so confident, while an American counsel consulted by the Anglo Co., had expressed the view that whilst it was not possible to pronounce with certainty upon the validity of the agreement, in his opinion the proposed lease was good under American common law, and would not be held to be in violation of the Anti-Trust Act. That aspect of the question had been most closely and carefully studied by the directors, and while they appreciated that there was a risk, it was believed to be a distant one. With full knowledge of the position, they had taken every step to effectually safeguard the interests of the shareholders, and ensure that should the lease be broken or even modified with their consent, they would be certainly in no worse position than they were when the Western Union repudiated the 1882 agreement. On March 1st last the Western Union ceased to hand over either to them or to the Anglo Co. any portion of the eastward traffic collected by them on the other side. That represented nearly 50 per cent. of the messages transmitted over the cables, which would show them the enormous loss that resulted to the English companies. That had brought about a reduction in their revenue for the four months to June 30th last from £42,500 to £28,290, as compared with the corresponding four months in 1910, or a decrease of £14,210, and that on the assumption that their original agreement with the Anglo Co. entered into in 1877 prior to the admission of the Western Union Co. would still have held good, and that they would receive their full proportion of the traffic of the two companies as provided under that agreement. In the intervening months they were from time to time informed that negotiations were proceeding between the Anglo and the Western Union Companies, and it was intimated to them that when those were completed the Western Union Co. would approach them with a view to entering into a similar arrangement. In the early part of July they were informed

that those two companies had come to an agreement, and the Western Union Co. then approached them. They might doubtless be disposed to ask him whether the arrangement might be broken by one of the parties, or whether it was not capable of being held invalid for the reasons he had already referred to. He thought they might look upon that in the light of the attitude and intention of the parties, and especially of the Western Union Co. He was convinced that the latter company would loyally endeavour to substantially uphold the agreement. Their negotiations with the Western Union Co. had resulted in the arrangement which had been communicated to them, and which the directors recommended them to accept. They carefully studied the possible alternatives—(1), to revert to the original agreement with the Anglo Co.; and, (2), to endeavour to work alone. The latter alternative seemed an impossible one, seeing that they had only one cable across the Atlantic, and that interruption thereto would result in complete loss of revenue; while, as regarded the other alternative, they had had four months' working with the Anglo Co. without the Eastern traffic coming from the Western Union Co.'s system, and the result had conclusively demonstrated that their receipts under the 1887 agreement would have been little more than sufficient to meet their working expenses. The question might be asked whether the two English companies could not have combined and established their own landline connections in America. He could only say that the institution of any such system by the English companies would have been a most costly undertaking, beset with such difficulties, including the strenuous opposition of existing telegraph companies in America, as to make it practically impossible of accomplishment, at any rate with the capital at the disposal of the English companies. He was bound to state that the Anglo Co. proceeded with their negotiations and came to their agreement without consulting them in any way, so it was obvious they could not count upon the co-operation of that company in attempting to provide their own means of communication between the cable ends and the interior of America. The only course, therefore, open to them was to come to the best arrangement possible with the Western Union Co., and he had no hesitation in saying that they had, after many months of anxious negotiation, succeeded in doing this, and had secured terms which they could honestly recommend for their acceptance. Under the arrangement proposed, the two most important points to be considered, in their judgment were, first, that the proposed lease was for the long period of 99 years, whereas the 1882 agreement would have expired in a little over nine years from now, when the company would be forced to deal with many complications; and, second, that they retained absolute control of their reserve fund, and in case of breach of the agreement, voluntary or otherwise, the cable and property connected therewith. Their cable was laid many years ago, and as he had often stated, the life of a cable not yet having been demonstrated, they could not say when it might be necessary to renew it. At the present time their cables were working as well as, if not better than, they had ever done, the diversion to Newfoundland having brought about, through the shortening of the main cable, and in other ways, a great increase in the speed in the transmission of messages. They had no reason, therefore, to assume that there would be any reason to lay another cable in the near future, or for a great many years to come, nor did they believe that the cost of repairs and maintenance would in future exceed that of recent years. The rental of £58,568 that they were to receive, ensured the shareholders for 99 years a dividend of 4 per cent., which would absorb £48,568, while the additional £10,000 a year, with a small sum to be taken when circumstances permitted, from the interest on the reserve fund investments, they had every reason to believe would enable them in ordinary circumstances to give a bonus equal to another 1 per cent., making 5 per cent. in all, the highest rate of dividend that the shareholders had ever received. They had also agreed with the Western Union that this 5 per cent. should not be exceeded except with their consent. That latter condition they regarded as being as much in their interests as in that of the Western Union Co. Their lessees desired to restrict the payment of dividends and bonus approximately to the rental that they were to pay, and to ensure that any balance remaining out of the interest on the reserve fund investments, after paying for the repair and renewal of the cable, should be added to the reserve fund so that the company might be prepared at any time, should the cable be beyond repair, to replace it. Inasmuch as the rental itself would cease, and the lease come to an end if there were no cable to work, it was entirely in the interests of the shareholders that the policy followed by the board in the past should be continued, viz., that the capital of the reserve fund should be maintained; and if they were fortunate enough to escape heavy expenditure for repairs to the cable, any balance of interest on the reserve fund, after making up the 5 per cent. dividend and bonus, should be added to the reserve fund. The policy of the board in future would be to pay a quarterly dividend at the rate of 4 per cent., and at the end of each half-year to take into account the expenditure upon repairs and renewals of the cable, and to declare, or not to declare, a bonus as the circumstances warranted. They had no valid reason to anticipate that the bonus they had hitherto received would not be continued, but should fortune desert them and the cost of repairs to the cable—say, about £12,600, as in the last six years—exceed the sum that they had to provide for it, viz., the interest on the reserve fund plus the £10,000 a year, then they felt that in the interests of the shareholders, it was desirable that they should in such a case distribute only the dividend of 4 per cent., keeping up the reserve fund for the purpose of laying another cable, which was after all the only security that they had for the payment of the rental under the lease. A provision was contained in the agreement that should the cable be interrupted for a period exceeding 12 months, the rental payable by the Western Union Co. was reducible by 50 per cent., and if it should be interrupted for a further six months, or 18 months in all, such rental ceased altogether. Under the so-called pool contract their participation, in case of interruption for 12 months, continued; if the default lasted for another year, the share was reduced, and came to an end after three years. When he told them that the longest period which their cable had been interrupted in the past had been five months, he thought they would agree that the period of 18 months might be considered as a sufficient safeguard. They had stipulated that the whole of the staff, with the exception of the secretary and his assistants, who naturally remained with them, were to enter the employment of the Western Union Co. at the salaries and on the terms and conditions of their existing contracts, and the Western Union Co. undertook to contribute an annual sum sufficient to maintain the pension scheme for the entire staff. They were, moreover, informed that the Postmaster-General had stipulated that the stations of the English companies should be staffed by British subjects. They had therefore satisfactorily ensured the future of their employés, and as they would shortly be passing into the service of the Western Union Co., he would like to express on behalf of the board, and he was sure the shareholders also, their warm appreciation of the loyalty and devotion to duty that had been characteristic of every grade of the service since the incorporation of the company. The existing articles of association provided that the minimum number of directors should be five, and the proposal to reduce that number to three was a domestic matter arising out of the agreement, and that reduction would doubtless meet with the approval of the shareholders.

Sir J. Pender, Bart., seconded the resolution.

The Chairman, in reply to questions, said that they had made this agreement for themselves, and it was quite independent of the Anglo agreement. As he had said, it was possible that there might be difficulties in America in continuing the agreement, and that point they had been studying for months. If anything of that sort should happen, their position would be no worse than it was now. The only thing they gave up were their rights under the 1877 agreement.

The resolution was carried unanimously.

Drake & Gorham, Ltd.—The directors' report for the year ended June 30th, 1911, states that after payment of all charges, including bonuses due to staff, there remains a net profit of £7,184, which, with the sum of £1,242 brought forward from the previous year, makes a total of £8,427, which it is proposed to appropriate as follows:—Dividend at the rate of 4½ per cent. per annum, £5,625; by writing off part of the underwriting commission, £1,500; carrying forward, £1,302. The improved results are mainly due to the increasing popularity of the electric light, especially in view of the large reduction in first cost and running expenses. The wholesale department has been further extended and an additional warehouse will shortly be ready for occupation.

Eastern Telegraph Co., Ltd.—A second quarterly interim dividend of 1¼ per cent. on the ordinary stock is announced.

Lisbon Electric Tramways, Ltd.—An interim dividend of 3 per cent. on account of earnings of the current year, is payable on November 1st.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ending September 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on November 1st.

County of Durham Electrical Power Co., Ltd.—The secretary has issued a circular to the shareholders as follows: "While the profits for the first six months of the current year, as shown by the cost sheets, are slightly better than those for the same period of last year, the directors, in view of the disturbed position of the labour world and the possible dislocation of local trades which may follow therefrom, do not think it advisable that an interim dividend on the preference shares should be paid."

Howard & Bullough, Ltd.—The directors have declared an interim dividend at the rate of 10 per cent. per annum (6d. per share), on the ordinary shares for the quarter ended September 30th.

Folkestone Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock, payable on the 1st inst. for the six months ending that date, have been posted.

Edgar Allen & Co., Ltd.—The directors have declared an interim dividend on the 5 per cent. cumulative preference shares for the half-year to September 30th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have announced an interim dividend for the quarter ended June 30th of 2s. 6d. per share.

Calcutta Tramways Co., Ltd.—An interim dividend of 2½ per cent. is announced.

Dick, Kerr & Co., Ltd.

Mr. John Kerr (chairman) presided on September 28th at the Cannon Street Hotel, E.C., over the ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 478), said that in dealing with the year's trading, he should like to remark that keen competition for orders had continued in all departments. It was all a question of supply and demand. The development of electrical power in ironworks, and the textile trades, and in many other industries, showed some progress. If this country did once lag behind Germany and America in the adoption of electricity it might fairly now be said that the greatest interest had been awakened. A considerable amount of plant had been ordered, and quite a number of important installations were under consideration. At their Preston works the very highest grade of machinery could be turned out in an economical manner by reason of good labour and the best modern equipment. Competition for business was acute enough between the home manufacturers, but it was increased by their market being an open one to Continental and American works. These happy manufacturers were secure in their home market, and had the British as a dumping ground. They had every opportunity of maintaining their output; to anyone who knew anything of manufacturing, the question of cost was largely one of output. To the working man, steady employment was better than intermittent work, even if the nominal wages were slightly higher per week. Work and plenty of it was equally essential to employer and employé. At the last general meeting they were told of the board's intention to manufacture steam turbines. The directors were pleased to state that their efforts in this direction were meeting with satisfactory results. There could be no question that this development was on the right lines. In view of the enormous demand for metallic-filament lamps, and the fact that the bulk of the lamps used of this class were of foreign manufacture, the directors, after careful investigation, decided to add a lamp factory. To avoid the danger of experimental work they had availed themselves of the experience of a Continental company. Their factory was now rapidly approaching completion, and would very soon be in a position to turn out lamps second to none in the market. The selling of the lamps would find employment for their various offices and agencies without material addition to the staff. It was the intention of the board to push this business with vigour. As regarded prospects for the coming year, they were encouraging. As soon as international difficulties, which had been causing considerable European anxiety, were settled, an amount of foreign work that was held in suspense should be proceeded with. Although they had been practically free from labour difficulties, there could be no doubt that strikes and threatened strikes all militate against business by delaying work or causing postponement of orders. It was to be hoped the Government would deal in no uncertain manner with "peaceful picketing," as the scenes that had recently taken place were a disgrace to the country and a source of public danger. Means could surely be found to deal with this clamant evil without in the slightest inflicting any injury to the just rights of trade unions. One serious and disastrous effect produced by the reckless policy of a certain section of labour leaders in inciting strikes of the nature and magnitude of those they had just experienced regardless of the loss and suffering they had produced, was to discourage and frighten the employers of the country and to restrain them from developing their resources for the general benefit of trade and consequently of labour itself. The balance-sheet represented a rather uneventful year, although the result showed an improvement on the two previous years. They would observe on the assets side an increase of £32,753 on capital expenditure; this was represented by the expenditure on the turbine business, the lamp factory, and some additional plant at the Kilmarnock works. Turning to the liabilities, they would notice that the debenture stock had been redeemed to the extent of £9,000. Altogether, since the issue of this debenture stock, £46,570 had been paid off and a reserve fund of £150,000 had been created under Clause 31 of the trust deed securing the debentures. It had always been the policy of the directors to strengthen the position of the debenture and preference shareholders. The contingent liability referred to in the balance-sheet as co-obligants with the Edinburgh and District Tramways Co., Ltd., in their liability to the Corporation of Edinburgh, under the lease of the tramways, would continue for about nine years. There need be no anxiety under this head, as the tramways were a remunerative undertaking of a first-class character. As they would see by the auditors' certificate, the plant and machinery had been amply depreciated. Regarding the investments, they had experienced, like many other concerns, the greatest depreciation in the securities recognised as gilt-edged, but this had been fully allowed for in adjusting the total valuation. The rearrangement of the staff necessitated by the lamentable death of Mr. George Flett last year had been carried out. Mr. Schultz, who has long been actively associated with the business, had been appointed assistant managing director. There was a desire by the staff and directors to commemorate the late Mr. George Flett's memory in a suitable manner; the money subscribed by them, in conjunction with a handsome donation by his daughter and one hundred guineas by the company, had been the means of endowing a bed in that noble institution, the London Hospital. The directors would like to record their high appreciation of the management and staff for the untiring energy they had displayed throughout the year, and their whole-hearted efforts to maintain the reputation of the company.

Mr. C. T. Cayley seconded the motion.

Mr. T Hacking pointed out that there were two items on the liability side of the balance-sheet about which he would like to ask. The first was "Special reserve, balance from last year £16,000," and the second, "Special reserve for extensions of the manufactories or replacements of machinery, &c., £50,000." He wished to know for what those two items were specially reserved.

The Chairman said the first one was made many years ago against possible liability under the Edinburgh tramways contract, and it had been allowed to remain, although they would never be called upon for any liability. The other was for the purpose for which it was stated.

Mr. Hacking asked why it was then that the £32,000 odd expenditure on new works had not been taken from this £50,000.

The Chairman said the board thoroughly discussed that matter, and decided to do what they had done, and leave the £50,000 intact to strengthen the company.

Mr. Hacking further asked if it would not be possible for the board to give the amount set down for goodwill and patents, instead of lumping it altogether with capital expenditure on work.

The Chairman said he would be glad to furnish any shareholder with any information he required, if he called at the office, but in a manufacturing concern, it was not always wise to disclose all their affairs publicly. They had, however, nothing to hide from the shareholders.

Mr. J. Russell Gubbins said he had always tried to insist on the amount set aside for goodwill being disclosed, and there were industrial companies who did so. He saw no reason why such a fact should not be stated, and he believed that eventually he would be able to bring such pressure to bear that every company in England would be compelled to disclose its goodwill.

The Chairman said that the board would consider the point raised, but if all companies were as careful as they were there would probably be less trouble in the City of London.

The report was then adopted, and on the motion of Mr. Barber Glen, a hearty vote of thanks was passed to the directors and staff.

Willans & Robinson, Ltd.—The directors' report for the half-year ended June 30th, 1911, to be submitted to the half-yearly meeting on Tuesday next, October 10th, states that after writing off £4,429 as depreciation, paying £4,174 interest on debenture stock, and £348, the cost of the upkeep of the Queen's Ferry Works, the result of the half-year's trading shows a loss of £7,693, as compared with £10,811 for the previous six months. Added to the balance £26,080 brought forward from the previous half-year, this brings up the total of the debit standing against the profit and loss account to £33,773. Although the company is securing its fair share of orders, the prices obtainable, due to the continued excessive competition, render these largely unremunerative. The company's area of operations is being judiciously extended. The economies referred to at the last half-yearly meeting, and which are only partially operative in the current balance-sheet, should materially assist the company in meeting the severe conditions at present existing. The regrettable lawsuit, referred to at previous meetings, involving a claim for £10,000 damages, has now been concluded, a verdict of £3,411 damages, with costs, being given against the company. The total cost to the company of this action amounts to £23,519. Provision against this liability to the extent of £3,863 has already been made, leaving a balance of £19,656 still to be dealt with. This matter concludes the liabilities arising out of the company's Queen's Ferry Works, prior to their being closed in 1908, and is in no way attributable to the company's business as carried on at Rugby.

Kalgoorlie Electric Power and Lighting Co., Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per annum for the six months ending September 30th.

Stothert & Pitt.—A financial daily states that after transferring £1,000 to reserve, the directors recommend a dividend of 3 per cent. on the ordinary shares, for the year ended June 30th, carrying forward £3,313.

STOCKS AND SHARES.

Tuesday Evening.

It would appear as though the Stock Exchange were getting accustomed to shocks of various kinds, political, financial and otherwise, and that they are beginning to lose their power of affecting the markets to any violent extent. Consequently, the outbreak of war between Italy and Turkey, while it produced a weakening of prices and imposed a further check upon business, quite failed to produce any sort of panic or even demoralisation. With the later telegrams suggesting an early termination to the dispute, the Stock Exchange was disposed to view the matter in a light not particularly serious, and the falls of Saturday were largely wiped out by a general recovery throughout the markets on Monday and Tuesday.

This week there has been rather more doing in the shares of the English Electricity Supply companies, but it has not been of the sort that kindles any particular pleasure in the minds of shareholders. Which is a round-about way of saying that prices are easier where they have moved at all. Charing Cross Ordinary are ¼ down, and the Preference eased off to 4. Metropolitan Ordinary and St. James's shed ¼ each, reducing the price of the latter to 8¼. In the Provincial list there is an improvement of 2s. 6d. in Bourne-

mouth and Poole Second Preference, while Folkestone Preference were reduced by the amount of their dividend, the Ordinary shares practically regaining theirs. Amongst the Debentures, the only changes are those produced by the marking *ex* dividend of South Metropolitan 4½ per cent. and Urban First Mortgage stocks.

In the Colonial and Foreign list, there is a much better tendency amongst the Mexican issues. This is due chiefly to the indirect influence of an excellent dividend on Mexican Railway stock, combined with evidences afforded by that company of the way in which affairs are settling down after the little revolution. Mexican Light and Power Preferred and Common moved up ½ each, the bonds rose 1, and Monterey Debenture improved to the same extent. Northern Light and Power bonds recovered 1, which brought the price to 37, and Montreal shares retained their good rise of last week. West Kootenay Sixes came into some request, and Electrical Development of Ontario bonds hardened up in sympathy. Canadian General Electric Common and Preferred recovered most of their dividend deductions. On Monday, Shawinigan Water capital stock was marked *ex* rights, and the value of the new stock was officially fixed for the time being at 4 premium.

In the Home Railway market, prices suffered a fairly severe decline at the end of last week on the Italian-Turkish *affaire*, added to which there were rumours that Germany had reopened the Morocco business, while hints circulated as to the possibility of a big miners' strike throughout the country to be declared within a day or two. The falls, however, were in most cases recovered, and the market has again swung on to a better level. There can be no doubt as to the shortage of stock which exists in this department, and it is this, rather than fresh buying on the part of investors, which sustains prices at the present time, when there is the cloud of the Railway Commission findings hanging over the situation. With regard to this latter, it is already taken for granted that the Commission will find that recognition of the Trade Unions by the companies ought to be advocated; but, on the other hand, it is hoped that, besides permission being given to raise freights, the Commission will have something to say on the point of making sudden strikes illegal.

So far as the Electric Railways are concerned, Metropolitan Ordinary is down half a point, and the Central London Preferred lost 1. Districts, however, are 1 up, this following upon an advance last week, and the company's 4 per cent. Debenture stock at 98 is also 1 higher. The progress which the District Company is making, and the ever-increasing density of the traffic which it is attracting are points which supporters of the company keep in mind. A good many small buyers of speculative stocks are putting away Districts, as they say, for their children, just as we in our younger days used to buy Chartered for posterity, although it is to be devoutly hoped that the subsequent result will not be the same in both cases. Underground Electric Railways Income bonds eased off to 58. Hastings Trams Preference shares remain at ¾, *ex* the dividend at 7½d. There are no changes in the London United descriptions.

The Telegraph market professed satisfaction at the meeting of the Anglo-American Telegraph Company last Friday, at which the chairman, Mr. F. A. Bevan, made a striking speech in favour of the agreement with the Western Union. The proposals were carried, but there is no change in prices, because some little uncertainty is still felt as to whether the arrangement will be allowed to stand under the Sherman Anti-Trust Acts of the United States, under which it is conceivable that the scheme might be construed as a monopoly in restraint of trade. Other American shares are unchanged, and the Eastern group keeps exceedingly steady. Amazon Telegraphs are ¼ easier at 7½. Direct Spanish Ordinary and Preference, *ex* their dividends, were left unaltered at their previous quotations. Reuters, also *ex* dividend, show no nominal movement at 9¼ middle. Globe Telegraph and Trust Preference went back ¼ to 13½, but they are not at all a bad market, and the Ordinary rose ¼ to 10¾.

Fresh animation has arisen in the National Telephone market, and, following upon a rise of 3 points last week, another gain of a point is shown now. The market has been depressed of late by forced selling, but this being practically completed, buying was resumed by those who are looking for the stock to be paid off at a handsome price when the company is taken over by the Government at the end of this year. The Third Preference hardened to 5½. Other Telephone shares are mostly firm. Monte Video Preference gained $\frac{1}{16}$. Oriental Ordinary rose $\frac{1}{16}$. New York bonds are ¼ higher, and the only decline in this section is one of $\frac{1}{16}$ in United River Plate Ordinary

Foreign Tramway bonds are also harder, substantial rises being secured by Mexico Trams, Rios and Sao Paulos, the latter putting on 2 points, and so recovering the dividend deducted a fortnight ago. Winnipeg Electric Railway 4½ per cent. Debenture is a little harder, and the demand for good bonds of this class has once more become perceptible. British Columbia Electric issues have firmed up.

The manufacturing group is very quiet. Castner-Kellners continue to droop, and Crompton Debenture at 60 shows a loss of 2½ points. Edison & Swan Second Debenture recovered 1½ of its interest, and Electric Construction Preference at 1½ are ¼ higher. The Electric Supply Corporation's recent issue of Debenture stock —with which the underwriters got left to the tune of about 95 per cent.—has not yet received the dignity of a market quotation, although it is understood that transactions do take place occasionally. The first interest payment was made this week. Willans & Robinson Ordinary were marked back a trifle on the issue of another report which can only be described as lamentable, a further big deficit being added to the existing burden. At the same time, the directors strike a note of subdued hope in respect of the orders which are coming in, although they complain of excessive competition.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 27	3,087	+ 124	17	27,988	+ 1,725	..	..
Ayr	„ 20	940	+ 354	20	8,486	+ 50	8	..
Bath	„ 27	1,765	— 81	39	33,685	+ 1,066	..	..
Birkenhead	Oct. 1	2,388	+ 117	26	30,821	+ 1,155	19·7	..
Birmingham Corp.	Sept. 23	18,118	+4,309	25	204,622	+34,657	56·8	..
Blackburn	„ 27	2,252	+ 158	26½	32,014	+ 2,862	14·6	..
Blackpool Corp.	„ 28	4,813	+ 984	..	50,784	+ 6,963	..	..
Blackpool-Fleetw'd	„ 30	2,119	+ 257	13	21,607	+ 1,827	..	..
Bolton	Oct. 1	4,846	+ 120	27	66,679	+ 4,6·3	26	..
Bournemouth	Sept. 27	4,019	+ 172	26	51,517	— 1,156	22	..
Bradford	„ 23	10,914	+ 755	25	143,203	+11,534	56	1·2
Brighton	Oct. 1	2,180	+ 42	26½	30,979	..	9·5	..
Bristol	Sept. 29	12,942	+ 385	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 22	472	+ 6	38	8,308	+ 54	3·65	..
Barnsley	„ 22	387	+ 55	„	7,030	+ 495	..	..
Barrow	„ 22	737	+ 188	„	11,8·5	+ 1,446	5·37	..
Devonport	„ 22	1,082	+ 126	„	19,048	+ 2,825	8·85	..
Gateshead	„ 22	2,082	+ 137	„	39,594	+ 2,260	11·25	..
Gravesend	„ 22	473	+ 46	„	8,219	+ 228	6·5	..
Greenock	„ 22	1,582	+ 274	„	27,817	+ 3,679	7·25	..
Hartlepool	„ 22	691	+ 87	„	10,559	+ 937	6·72	..
Kidderminster	„ 22	258	+ 20	„	4,668	+ 327	..	..
‡Leamington	„ 22	485	— 2	„	6,996	+ 484	..	..
Merthyr	„ 22	449	+ 6	„	8,026	+ 128	2·9	..
Metropolitan	„ 52	18,628	+2,331	„	337,154	+42,516	29	..
Middleton	„ 22	694	+ 32	„	13,802	+ 1,1·0	8·5	..
Mid. Joint Com'tee	„ 22	8,812	—2,000	„	208,728	—10,256	..	..
Oldham—Ashton	„ 22	1,176	+ 43	„	21,9:0	+ 820	9·18	..
Peterborough	„ 22	275	+ 41	„	4,952	+ 535	5·31	..
Potteries	„ 22	4,059	+ 291	„	73,222	+ 6,971	29	..
Rothesay	„ 22	550	+ 5	„	9,341	+ 82	2·75	..
Southport	„ 22	661	+ 19	„	12,041	+ 531	8·15	..
S. Metropolitan	„ 22	1,825	+ 68	„	33,734	+ 2,066	..	..
Swansea	„ 22	2,414	+ 149	„	43,909	+ 2,667	12·5	..
Tynemouth	„ 22	605	+ 25	„	10,918	+ 481	3·76	..
Weston-s-Mare	„ 22	590	+ 129	„	7,573	+ 1,016	3	..
‡Worcester	„ 22	712	+ 86	„	11,550	+ 622	5·71	..
Wrexham	„ 22	229	+ 23	„	3,889	+ 198	..	..
Yorks. Wool. Dist.	„ 22	2,183	+ 43	„	40,295	+ 2,842	17	..
Miscellaneous	„ 22	468	+ 36	„	8,834	+ 517	..	..
Burnley	„ 30	2,709	+ 125	..	..	..	11·7	1
Burton-on-Trent	Oct. 1	555	— 137	26	7,875	+ 527	6··	..
Bury	„ 1	2,513	— 8	26	35,098	+ 3,208	22·5	..
Cardiff	Sept. 24	4,861	+ 240	25	64,554	+ 5,843	..	..
Chatham and Dist.	„ 28	1,803	— 147	39	33,844	+ 319	4·9	..
Cork	„ 28	999	— 4	39	19,845	+ 597	9·9	..
Croydon	„ 23	3,610	+ 167	..	47,585	+ 4,037	..	..
Darlington	„ 30	449	+ 49	27	6,089	+ 623	..	..
Darwen	„ 29	523	+ 57	26	7,195	+ 620	4·4	..
†Dover	„ 23	289	+ 53	25	7,291	+ 1,169	1·76	..
Dublin	„ 29	11,010	— 318	..	88,815	+10,274	54	..
Dundee	„ 27	2,897	— 92	19⅔	23,494	— 397	10	..
East Ham	„ 30	2,181	— 42	26	29,298	+ 1,452	7·87	..
†Exeter	„ 29	302	+ 17	26	9,722	+ 815	5·5	..
Glasgow	„ 30	41,990	+2,987	..	..	..	98	·75
Hastings	„ 28	2,376	+ 180	..	..	..	..	..
Huddersfield	„ 30	4,194	+ 396	26	52,855	+ 6,245	29·5	1
Hull	„ 30	6,631	+ 259	26	74,7·4	+ 3,711	14·5	..
Ilkeston	„ 28	268	— 11	26	3,542	+ 109	..	..
Ipswich	„ 30	954	+ 27	26	12,924	+ 860	10·5	..
†Kilmarnock	„ 23	161	+ 18	19	3,330	+ 329	4·2	..
Lancashire United	„ 27	2,745	+ 60	39	57,182	+ 1,529	39	..
Leeds	„ 30	15,184	+ 820	26	200,924	+14,265	108	..
Leicester	„ 30	5,051	+ 238	..	..	..	..	..
Leith	„ 30	1,295	+ 51	19⅔	13,988	+ 1,151	3·7	..
Liverpool	„ 25	23,366	+1,066	38	434,749	+12,572	118	·5
†L.C.C.	„ 20	87,118	+2,937	..	1,109,091	+65,328	141·6	9·5
London United	„ 30	13,312	— 297	..	261,844	+10,547	..	..
Lowestoft	„ 24	589	— 25	51	11,436	+ 1,042	2·5	..
Manchester	„ 30	32,531	+1,080	26	429,678	+24,256	189	..
Newcastle	„ 30	8,411	+ 708	..	112,944	+ 8,231	14·5	..
Newport	„ 28	1,867	+ 18	25	18,606	+ 931	14·5	..
Oldham	Oct. 1	3 859	+ 187	27	53,024	+ 2,161	23·7	·5
†Pontypridd	Sept. 30	410	— 27	26	11,048	— 29	5·5	..
†Portsmouth	„ 28	2,247	+ 76	25	63,332	+ 6,112	15·25	..
Preston	„ 27	1,555	+ 139	26	20,995	+ 1,629	..	..
Rotherham	„ 28	1,356	+ 84	25½	17,878	+ 1,562	12	..
Salford	„ 25	9,766	+ 729	25½	126,452	+ 6,292	..	..
Sheffield	Oct. 3	13,816	+ 648	27	174,316	+11,557	40	..
Southampton	Sept. 27	2,630	+ 372	26	34,0·9	+ 4,555	22	..
Southend-on-Sea	„ 27	1,090	+ 321	26	21,434	+ 3,390	..	..
South Shields	„ 30	1,198	+ 54	26	17,192	+ 2,001	..	..
†Swindon	„ 27	180	+ 26	..	4,312	+ 516	..	..
Tyneside	„ 27	949	+ 141	15	7,216	+ 942	..	..
Wallasey	„ 30	2,177	+ 277	26	30,826	+ 4,749	..	..
Walthamstow	„ 30	1,415	— 73	26	21,283	+ 1,691	9	..
West Ham	„ 21	5,443	+ 415	25	69,546	+ 6,906	15·25	..
Wolverhampton	„ 27	1,938	+ 79	26	26,984	+ 1,720	25	..
Cen. London Rly.	„ 30	9,524	—1,601	18	56,842	—11,888	6·32	..
City & S. Lon. Rly.	Oct. 1	6,321	+ 112	13	89,749	— 356	7·26	..
Dublin-Lucan Rly.	Sept. 29	323	+ 2	13	2,262	— 41	7	..
G.N. and City Rly.	„ 30	2,819	+ 46	13	17,548	+ 269	3·5	..
L'pool Overh'd Rly.	Oct. 1	3,086	+ 270	..	20,138	+ 998	6·3	4·3
Llandudno-Col. Bay	Sept. 29	805	+ 90	43½	13,986	+ 822	..	..
London Elec. Ry. Co.	„ 20	25,295	+1,005	13	152,890	+ 2,490	21·25	..
Mersey Railway	„ 30	4,133	+ 72	13	23,871	— 1,888	4·5	..
Metropolitan Rly.	Oct. 1	38,089	— 838	13	209,616	— 5,289	24·5	..
Met. District Rly.	Sept. 30	22,187	+ 944	13	127,410	+ 5,761	24	..
Anglo-Argentine	„ 30	95,816	+3,650	..	1,899,214	+173,928	..	..
§Auckland	Sept.	15,905	+1,310	3	48,272	+ 3,617	23·3	·6
Bombay (B.E.T.)	Sept. 1	5,475	+ 42	35	90,845	+ 5,809	..	..
§Brisbane	August	24,650	+2,700	8	168,590	+19,725	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 30	8,505	+1,108	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	August	3,853	..	8	27,697	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 30	1,462	+ 201	..	26,652	+ 2,331	..	..
§Montevideo	Sept.	23,946	+1,886	11	278,519	+16,540	..	..
Perth (W.A.)	Sept. 29	3,105	+ 572	..	62,452	+14,137	20	..

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	*					
Do. 4½ % Pref.	10	5½	5½	7⅞ — 8⅛	..	6 5 9
Do. Second 6 % Pref.	10	4½	4½	8¼ — 9½	..	4 12 4
Do. 4½ % Deb. Stock	10	6	6	10¼ — 10⅝	+ ⅛	5 12 11
Brompton & Kensington, Ord.	Stock	4½	4½	101 —103	..	4 7 5
Do. 7 % Cum. Pref.	5	10	10	7⅜ — 8⅛	..	6 3 1
Central Electric Supply, 4 % Guar. Deb.	5	7	7	7⅜ — 7⅛	..	4 7 6
Charing Cross, West End & City	100	4	4	99 —102	..	3 18 5
Do. 4½ % Cum. Pref.	5	5	5	3⅞ — 4⅛	— ⅛	6 1 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. Do. 4 % Deb.	5	4½	4½	3⅞ — 4¼	— 1/16	5 5 11
Chelsea, Ord.	100	4	4	94 — 98	..	4 1 8
Do. 4½ % Deb.	5	4½	5	3½ — 4⅜	..	5 14 3
City of London, Ord.	Stock	4½	4½	98 —100	..	4 10 0
Do. 6 % Cum. Pref.	10	7	7	12 — 12½	..	5 12 0
Do. 5 % Deb.	10	6	6	11⅞ — 12⅜	..	4 14 1
Do. 4½ % Second Deb.	Stock	5	5	119 —123	..	4 1 4
County of Durham, 5 % First Mort. Deb.	100	4½	4½	100 —103	..	4 7 5
County of London, Ord.	Stock	5	5	89⅜ — 91½	..	5 9 8
Do. 6 % Pref.	10	5	5	7⅜ — 7⅝	..	6 7 0
Do. 4½ % Deb.	10	6	6	10⅞ — 11⅛	..	5 6 8
Do. 4½ % Second Deb.	Stock	4½	4½	108 —110	..	4 1 10
Edmundson's, Ord.	Stock	4½	4½	100½ —103½	..	4 7 0
Do. 6 % Cum. Pref.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 4½ % First Mort. Deb.	5	Nil	Nil	2 — 2½	..	Nil
Folkestone	100	4½	4½	83 — 86	..	5 4 8
Do. 5 % Cum. Pref.	5	5½	6	4⅜ — 5 xd	+ ⅛	6 0 0
Do. 4½ % First Deb.	5	5	5	4⅜ — 5½ xd	..	4 17 7
Hove	100	4½	4½	95 — 98	..	4 11 10
	5	8½	9	6⅜ — 7⅜	..	6 2 0

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	*					
Do. 4 % Deb.	5	8	9	6½ — 7⅛	..	6 0 0
Kent Elec. Power, 4½ % Deb.	Stock	4	4	91 — 93	..	4 6 6
London Electric, Ord.	Stock	4½	4½	80 — 84	..	5 7 2
Do. 6 % Pref.	3	2	2	1⅝ — 2	..	3 0 0
Do. 4 % First Mort. Deb.	5	6	6	4¼ — 4⅞	..	6 3 1
Metropolitan	Stock	4	4	89 — 92	..	4 7 0
Do. 4½ % Cum. Pref.	5	5	5	3½ — 4	— ⅛	6 5 0
Do. 4½ % First Mort. Deb.	5	4½	4½	4⅛ — 4⅜	..	4 14 2
Do. 3½ % Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Midland Electric Corporation 4½ % First Mort. Deb.	Stock	3½	3½	84½ — 87½	..	4 0 0
Newcastle-on-Tyne	100	4½	4½	96½ — 98½	..	4 11 5
Do. 5 % Pref., Non. Cum.	5	4	4	3⅛ — 4	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	5	5	5	3⅜ — 3⅝	..	6 9 0
Notting Hill	100	5	5	101 — 104	..	4 16 2
Oxford	10	7½	8	..	..	..
St. James' and Pall Mall, Ord.	5	7	7½	6 — 6⅛	..	5 11 6
Do. 7 % Pref.	5	10	10	8½ — 9	— ⅛	5 11 1
Do. 3½ % Deb.	5	7	7	6½ — 7⅛	..	4 16 7
Smithfield Markets, Ord.	100	3½	3½	85 — 87	..	4 0 6
South London, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
Do. 5 % First Mort. Deb.	4	5	5	2⅜ — 3	..	6 13 4
South Metropolitan, 7 % Pref.	100	5	5	98½ —101½	..	4 18 6
Do. 4½ % First Deb. Stock	1	7	7	1⅜ — 1⅝	..	5 17 11
Urban, Ord.	100	4½	4½	95 — 98 xd	..	4 11 10
Do. 5 % Cum. Pref.	5	5	5	⅞ — 1	..	..
Do. 4½ % First Mort. Deb.	5	5	5	2 — 2½	..	..
Westminster, Ord.	100	4½	4½	85½ — 87½ xd	..	5 2 10
Do. 4½ % Cum. Pref.	5	10	10	7⅛ — 8	..	6 5 0
	5	4½	4½	4⅞ — 5⅛	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8	8½	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 10 11
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	104 —108 xd	+2½	6 9 8
Do. 7 % Pref.	$100	7	7	118 —122 xd	+ ½	5 14 9
Cordoba Lt., Power and T., Ord.	1	2	3	¾ — ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	92 — 95 xd	..	5 5 3
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	85½ — 87½	+ ½	5 14 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	13/16 — 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	..	4 16 7
Madras, Ord.	5	Nil	..	2⅜ — 2⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	..	5 13 0
Mexican Lt. & Power, Common	$100	4	4	85½ — 87½	+ ½	4 11 5
Do. 7 % Cum. Pref.	$100	7	7	107½ —109½	+1½	6 7 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	93½ — 95½	+1	5 4 9

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	+1	5 9 11
Montreal, Lt., H. and Power	$100	6	7	167 —172	..	4 1 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	36 — 38	—1	13 3 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	+1	4 9 1
Shawinigan Water, Capital	$100	4	4	115 —117	..	3 8 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1/16 — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	105½ —107½	+ ½	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅛ — 7⅞	— ⅛	Nil.
Do. 5 % Deb. Red.	Stock	5	5	99 —101	..	4 19 0
American Telep. & Teleg., Cap.	$100	8	8	136 —140 xd	..	5 15 11
Do. Collat. Trust	$1000	4	4	93 — 95	—1	4 4 3
Anglo-American Telegraph	Stock	3½	3½	67 — 69	..	5 5 8
Do. 6 % Pref.	Do.	6	6	111½ —112½	+ ½	5 6 8
Do. Def.	Do.	25/-	30/-	24⅜ — 25⅛	..	5 19 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6⅛ — 7⅜	..	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86⅛ — 88⅛ xd	+1	4 10 5
Cuba Telegraph	10	6	6	10¾ — 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17⅞ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4 xd	+ ⅛	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8¾ xd	+ ⅛	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	..	4 8 3
Direct United States Cable	10	4½	4½	7⅞ — 8⅛	..	5 9 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99½ —101½	+ ½	4 8 8
Eastern Telegraph, Ord. Stock	Stock	7	7	137 —140	..	5 0 0
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102½ —104½	..	3 16 7
Eastern Extension	10	7	7	13¾ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	100½ —102½	..	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	..	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10⅝ — 11½ xd	+ 3/16	5 5 7
Do. 6 % Pref.	10	6	6	12⅞ — 13⅜	— ⅛	4 9 9
Great Northern Telegraph	10	18	18	30½ — 31½	..	5 14 3
Indo-European Telegraph	25	18	18	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	83 — 86	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	74 — 76	..	5 5 3
Marconi's Wireless Telegraph	1	Nil	Nil	2/16 — 2 1/16	..	..

Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	31/32 — 1 1/32	+ 1/32	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106	..	5 18 2
Do. Def.	Do.	6	6	118 —121	+1	4 19 2
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅛	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅛	..	5 17 1
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5⅜	+ 1/16	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	99 —101	..	3 9 4
Do. 4 % Deb.	Do	4	4	99 —101	..	3 19 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	+ ⅛	4 8 7
Oriental Telep. and Elec.	1	8	8	1⅜ — 1⅝	+ 1/16	4 14 10
Do. 6 % Cum. Pref.	1	6	6	1⅞ — 1⅞	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5	9 — 9⅛ xd	+ 3/16	4 4 3
Submarine Cables Trust	Cert.	6	6	133 —136	..	4 8 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅛ — 7⅞	— 1/16	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	Nil	⅜	2⅜ — 2⅞	— ⅛	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅛ — 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅞ — 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13½ — 13⅞	..	5 1 10
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
Western Union Tel., 4% Bnds. A	$1000	4	4	107 —110	..	3 13 9
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations Oct. 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	5/8 — 3/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	77 — 81 xd	..	5 11 1
Brit. Elec. Trac., Ord.	10	Nil	Nil	1/16 — 1/8	..	Nil
Do. 6 % Pref.	10	1½	1½	8½ — 9¼	..	3 17 5
Do. 5 % Deb.	100	5	5	90 — 93 xd	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	74 — 78	..	5 15 5
Central London Railway, Ord.	100	8	8	65 — 67	..	4 9 7
Do. Pref.	100	4	4	84 — 86	—1	4 13 0
Do. Def.	100	2	2	48 — 50	..	4 0 0
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1½	28½ — 29½	..	5 1 8
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1908	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1/16 — 1/8	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1/8 — 1/4 xd	..	Nil
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 13 11
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2½ — 3	..	4 3 4
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	8 — 8½	..	Nil
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3
Metropolitan Railway Consol.	100	1	1⅜	41½ — 41¾	— ⅛	3 5 2
Do. Surplus Lands	100	2⅜	2⅜	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	24½ — 25	+1	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	97 — 99	+1	4 0 10
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3⅜	85 — 87	..	3 14 9
Do. 3½ % Gtd.	100	3½	3½	73 — 75	..	4 13 4
Metropolitan Elec. Trams, Ord.	1	5	5½	33/32 — 1 1/16	..	5 6 8
Do. Def.	1	Nil	Nil	1/32 — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	1 — 1	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100 —102 xd	..	4 18 0
Potteries, Ord.	1	2	2	1/16 — 1/8	..	..
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	7 12 4
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	1/8 — 1/4	..	10 3 0
Do. 4 % Deb.	100	4	4	72 — 77	—1	5 3 11
Underground Elec. Railways	10	..	..	1/8 — 1/4	..	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	Nil	1	57 — 59	—2	1 18 11
Do. Power House Debs.	100	..	4	100 —102 xd	+1	3 18 5
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2¾	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 2nd Pref.	5	5	5	4⅜ — 5	..	5 0 0
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 8 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	103 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Do. 6 % 2nd Deb.	100	6	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅛	..	5 12 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	103 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	139½ — 143½	+1½	5 11 6
Do. Pref. Ord.	100	6	6	120 —124	+1	4 16 9
Do. 5 % Pref.	100	5	5	107⅞ — 110½	+ ⅜	4 10 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½ — 103½	..	4 5 4
Calcutta Trams, Ord.	5	4½	6	5⅛ — 6⅛	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	1/16 — 1/8	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5 1/16 — 5 1/8	..	4 12 6
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100¼ — 102½	..	4 17 7
Kalgoorlie Elec. Trams	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3
La Plata Elec. Trms, Prf.	1	6	6	3/8 — 1 3/32 xd	..	5 16 4
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	96 —100	—1	5 0 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 92	..	5 8 8
Manila Elec. R. and Lig., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7	118 —120	+4	5 16 8
Do. Gen. Con. 5 % Bonds	..	5	5	97 — 99	+ ½	5 1 0
Do. 6 % Bonds	100	6	6	97 — 99	..	6 1 8
Para Elec. Rlys. & Lt., Ord.	5	..	10	6⅜ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	6 4 4
Do. 5 % 1st Deb.	100	5	5	99 —101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	2½	1⅜ — 1⅝	..	2 7 1
Do. 5 % 1st. Deb.	100	5	5	101 —103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	1	4½	116¾ — 117¾	+1⅜	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101½ — 102½	+ ½	4 17 10
Do. 5 % Mort. Bonds	100	5	5	95¼ — 96¼ xd	..	5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	173 —176	+2	5 14 11
Do. 5 % 1st Deb.	$500	5	5	102¾ — 104¾	..	4 15 8
Singapore Trams, 5 % Deb.	100	5	5	82 — 85 xd	—1	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	5	6	5⅛ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	105½ — 107½	+ ½	4 3 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	1/16 — 1 1/32	— 1/32	Nil
Do. 6 % Pref.	1	12	9	1 1/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	24	26	5 1/16 — 5⅛ xd	..	4 10 5
Do. Pref.	1	6	8	1 1/16 — 1⅛ xd	..	4 0 0
B.I. & Helsby Cables	5	10	10	6 — 7⅛	..	4 17 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	8	Nil	Nil	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	99 —101 xd	..	5 18 10
Browett, Lindley, Ord.	1	Nil	Nil	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	Nil	1/16 — 1/8	..	Nil
Do. 7 % Pref.	2	Nil	Nil	1/8 — 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 17 11
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 7/16 — 3 5/8	— 1/16	4 18 8
Do. Deb.	100	4½	4½	103 —107	..	4 4 1
Crompton & Co.	8	Nil	Nil	1/8 — 3/16	..	Nil
Do. Deb.	100	5	5	55 — 65	—2½	7 13 10
Dick, Kerr	1	6	5	1 3/16 — 1 1/4	..	5 6 8
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	5 12 11
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	2 — 2 1/16	..	Nil
Do. fully paid	5	Nil	Nil	1 3/4 — 2 1/16	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 6
Do. 5 % Second Deb.	100	5	5	77 — 80 xd	+1½	6 5 0
Electric Construction	2	Nil	2½	1/4 — 3/8	..	6 13 4
Do. Pref.	2	7	7	1½ — 1¾	+ 1/16	7 4 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8½ — 9	..	5 11 1
Do. Deb.	100	4	4	86 — 91 xd	..	4 7 11
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	106½ — 108½	..	4 2 11
India-Rubber, G. & T.	10	10	10	13½ — 15½	..	6 9 0
Do. Pref.	10	5	5	9½ — 10½	..	4 16 5
Telegraph Construction	12	17½	20	34½ — 36½	..	3 18 5
Do. Deb.	100	4	4	100 —102	..	..
Willans & Robinson	1	Nil	Nil	3/32 — 3/16	— 1/32	Nil
Do. Pref.	5	1½	Nil	3/4 — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 8 1

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 4 per cent., September 21st, 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1911.

Compared with the previous month's returns, those for August show considerable improvement as regards the export section, but, on the other hand, a marked falling off in the value of both imports and re-exports.

The exports from this country totalled some £399,149, a figure which compares with £356,645 in July, and has only once this year been exceeded (in March last). Even neglecting the £50,000 worth of telegraphic material the return is a very satisfactory one.

The import total for August reached £179,375, as compared with £188,360 in the previous month, and the re-export figures for the same months were £9,795 and £19,791 respectively—the former value being the smallest recorded during two years past.

During the month electrical machinery exports amounted to over £168,000, while the exports of telegraphic material, telephonic material, and of wires and cables were in each case in excess of £50,000. The export business in lamps reached £16,800 in value, and is steadily improving, month by month; it may also interest some to notice an export from this country to Belgium of nearly £30,000 of telephonic material—a reversal of the state of things existing a few years back. The individual items of the imports are mostly less in value than in July, but machinery and lamp imports are slightly better; otherwise they call for no comment.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	324	230	159	229	125	3,102	37	...	...	20	166	4,392
Germany	1,823	1,992	34	704	314	2,504	...	46	...	...	37	7,454
Netherlands, Java and Dutch Indies	1,105	675	162	72	43	619	...	62	...	13	15	2,766
Belgium	876	...	78	144	64	2,027	176	...	...	29,164	260	32,789
France	742	...	338	16	27	1,563	1,144	...	160	154	178	4,322
Portugal	22	45	...	...	...	73	801	2	...	...	...	943
Spain and Canary Isles	58	15	206	20	254	3,074	27	...	...	...	5,000	8,654
Switzerland, Italy and Austria-Hungary ...	365	...	15	28	800	2,868	72	9	...	...	19	4,176
Greece, Bulgaria and Turkey	19	108	150	43	...	245	...	92	...	15	127	799
Channel Isles, Gibraltar, Malta and Cyprus ...	46	1,828	14	21	97	341	2	95	...	...	312	2,756
U.S.A., Philippines and Hawaii	168	57	318	1,069	20	317	60	...	23	...	32	2,064
Canada and Newfoundland	996	2,721	979	455	866	9,930	...	1,328	139	25	64	17,503
British West Indies, British Guiana and Falkland Islands	158	...	21	54	4	...	342	33	...	65	64	741
Mexico and Central America	...	1,090	...	...	...	1,205	...	...	...	22	43	2,360
Peru and Uruguay	239	...	543	58	79	181	...	18	...	...	...	1,118
Chile	278	715	705	117	80	3,523	2,173	1,605	21	189	213	9,619
Brazil	603	1,902	531	525	10	3,496	883	429	70	794	12,599	21,842
Argentina	1,649	3,947	997	1,050	741	6,675	...	3,425	12	4,696	2,891	26,083
Colombia, Ecuador and Bolivia	23	...	33	...	...	30	...	...	...	141	...	227
Egypt, Tunis, Persia and Morocco	402	206	187	169	50	1,343	1,622	353	...	234	275	4,841
British West Africa and St. Helena	36	99	95	...	433	210	2	37	...	77	316	1,305
Rhodesia, O.R.C. and Transvaal	2,235	1,145	438	2,705	499	10,344	15	265	108	63	932	18,749
Cape of Good Hope	1,667	1,746	282	1,130	491	20,806	12	181	28	278	807	27,428
Natal	1,244	5,858	638	804	45	7,625	27	204	54	22	100	16,621
British East Africa, Mauritius and Aden ...	29	181	24	177	37	353	2	...	...	283	18,098	19,184
Azores, Madeira and Portuguese Africa ...	522	924	24	...	9	339	...	34	...	57	44	1,953
French African Cols., Madagascar & Indo-China	227	125	128	...	37	54	72	...	...	...	298	941
China and Siam	429	362	120	255	161	4,344	...	8	...	219	167	6,065
Japan and Korea	1,300	98	33	45	245	15,539	1,777	1,214	80	2,871	4,837	28,039
India	2,480	8,380	1,514	3,959	956	11,927	2,817	3,414	139	227	813	36,626
Ceylon	143	193	100	237	10	421	8	66	...	...	24	1,202
Straits Settlements and Fed. Malay States ...	350	3,487	110	98	45	570	866	32	...	271	102	5,931
Hong Kong	32	85	70	33	172	456	107	37	...	114	...	1,106
West Australia	873	156	7	133	9	454	...	10	...	17	126	1,785
South Australia	289	446	218	196	39	1,524	400	5,247	...	309	22	8,690
Victoria	1,041	8,242	389	452	365	5,055	349	79	...	6,974	583	23,529
New South Wales	1,051	8,074	250	1,263	260	6,726	353	1,110	88	1,918	...	21,093
Queensland	135	...	...	155	34	5,507	334	...	69	448	200	6,882
Tasmania	35	...	...	...	...	...	...	...	...	...	24	59
New Zealand and Fiji Islands	1,526	1,010	438	396	558	10,863	100	218	...	795	607	16,511
Total, £	25,541	56,142	10,348	16,812	7,979	146,233	14,580	19,653	991	50,475	50,395	399,149

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	46	...	...	49	7	992	148	674	...	6,635	8,551
Germany	3,820	4,272	2,406	22,973	2,183	64,624	335	1,025	5,060	19,960	126,658
Holland	160	...	...	354	...	112	...	...	71	...	697
Belgium	457	1,142	...	40	11	1,697	60	151	303	5,829	9,690
France	58	...	572	1,599	358	330	...	621	2,835	819	7,192
Switzerland	160	805	156	57	75	2,102	10	...	...	170	3,535
Italy	18	395	...	5	...	262	...	...	...	524	1,204
Austria-Hungary	6	311	...	200	...	8	...	6	493	282	1,306
United States	3,738	1,045	197	1,044	...	9,387	4,252	290	50	268	20,271
Total, £	8,463	7,970	3,331	26,321	2,634	79,514	4,805	2,767	8,812	34,487	179,104

Additional imports: Portugal, batteries, £3; machinery, £40. Spain, carbons, £70. Japan, machinery, £15. Canada, goods, £129; machinery, £14.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	5,147	1,756	...	912	...	1,056	...	256	334	38	296

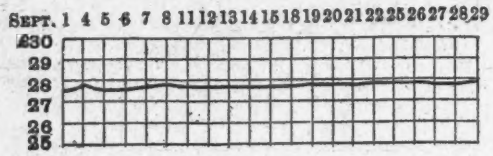
Total Exports: £399,149. Total Re-Exports: £9,795. Total Imports: £179,375.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

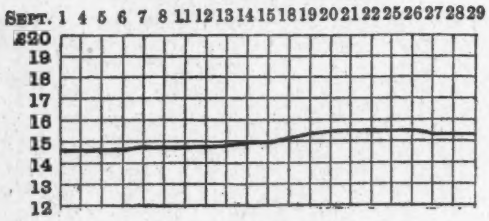
METAL MARKET.

Fluctuations in September.

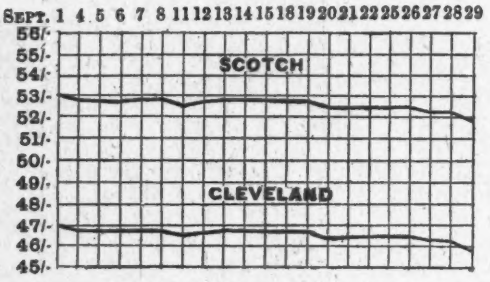
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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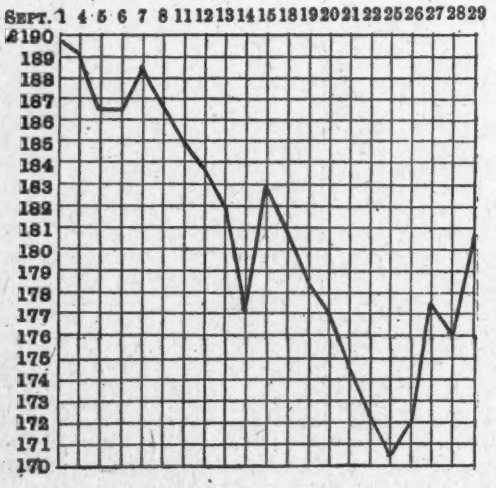
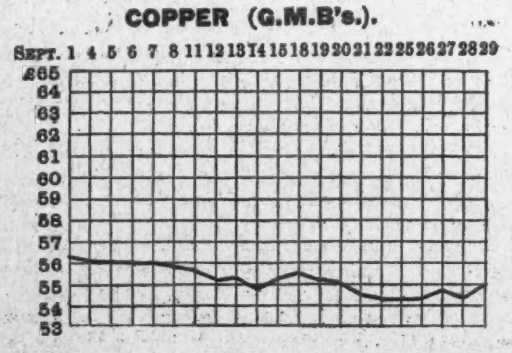


COPPER (G.M.B's.).



ELECTRIC COOKING: ITS PRESENT POSITION AND COST.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E.

With the evolution of the very much more reliable electric cooking apparatus which is now available, greater and greater interest has been aroused of late as to its applications and costs of operation. Such data are difficult to obtain, and mean much troublesome investigation and experimental work. Still, the matter is of such great importance in connection with the possibilities of the extension of the sale of electrical energy, that it is well worth the time expended in investigating it. For some years past the writer has given considerable attention to the subject on account of its bearing on central station electricity supply, and he has accordingly been asked by the Editors of the Electrical Review to set forth, for the benefit of others, some of the data he has collected; he further hopes that others, who happen to have any useful data, will allow them to be published for the common good.

Before entering into specific details, it will be well to summarise the present position of electric cooking, which is not a case of possibilities, but rather one of actualities. There is now no question at all as to the quality of the cooking carried out by the electrical method, simply because the way of applying the heat is an ideal one which is under perfect control. Electrically cooked food has a specially attractive flavour of its own, and it is always properly cooked through—not half-burnt and dried on one side or the exterior, and half-done elsewhere. A great deal of attention has been drawn of late to the advantages of paper bag cookery—and rightly so, in the opinion of the writer, for if intelligently handled, results can be obtained which nearly equal those attained with the electric oven, without the bags, be it noted. In other words, paper bag cookery has not so many advantages in conjunction with the electric oven, though, of course, it adds to the cleanliness of the operation of cooking, since there are no pots and pans to cleanse if the paper bags are used. Also when several dishes are being cooked together, paper bags prevent an intermingling of flavours and aromas.

While many admit the excellent quality of electric cooking, they still consider it to be a luxury beyond the reach of ordinary mortals. This, however, is not the case, for it is an interesting fact that if coal or gas cost nothing, it would still be cheaper to cook a joint of meat in an electric oven and pay a comparatively high rate per unit for electricity. For the loss due to the process of electric cooking is so slight, as compared with that sustained when gas and coal ovens are employed, that a very considerable saving is effected on the butcher's bill, so much so that, after paying for the electricity, and assuming that nothing was paid for gas or coal, the housekeeper would still have money in hand. The following tables and chart, giving the results of various experiments carried out in private houses, show clearly what an important matter this is, and what a definite saving of money may be brought about by the use of the electric oven.

BEEF.

Weight of joint when cooked.	Weight to be ordered from butcher when cooking is to be done by						Saving of meat and money when electricity is used instead of					
	Elect'ty.		Coal.		Gas.		Coal.			Gas.		
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	s. d.	lb.	oz.	s. d.
4	4	8	5	11	5	14	1	3	1 2	1	6	1 4
5	5	11	7	3	7	6	1	8	1 6	1	11	1 8
6	6	13	8	9	8	13	1	12	1 9	2	0	1 11
7	7	15	10	0	10	5	2	1	2 1	2	6	2 4
8	9	2	11	7	11	13	2	5	2 4	2	11	2 8
9	10	4	12	14	13	4	2	10	2 7	3	0	3 0
10	11	6	14	5	14	11	2	15	2 11	3	5	3 4
11	12	8	15	11	16	3	3	3	3 2	3	11	3 8
12	13	10	17	2	17	11	3	8	3 6	4	1	4 1

In the above and also in the succeeding table, the joints were nicely done and thoroughly cooked through. Of course, if they had been underdone, the shrinkage in the case of the coal and gas ovens would not have been quite as much. Mrs.

Beeton's Standard Cookery Book states that in ordinary roasting a loss occurs of anything from one-quarter to one-third of the weight of the joint. This is a further confirmation of the correctness of these tables.

MUTTON.

Weight of joint when cooked.	Weight to be ordered from butcher when cooking is to be done by						Saving of meat and money when electricity is used instead of					
	Elect'ty.		Coal.		Gas.		Coal.			Gas.		
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	s. d.	lb.	oz.	s. d.
4	4	8	5	7	5	8	0	15	0 10	1	0	0 10
5	5	11	6	13	6	15	1	2	1 0	1	4	1 1
6	6	13	8	2	8	5	1	5	1 1	1	8	1 3
7	7	15	9	7	9	11	1	8	1 3	1	12	1 6
8	9	2	10	13	11	2	1	11	1 5	2	0	1 8
9	10	4	12	2	12	8	1	14	1 7	2	4	1 11
10	11	6	13	8	13	15	2	2	1 9	2	9	2 2
11	12	8	14	14	15	5	2	6	2 0	2	13	2 4
12	13	10	16	4	16	11	2	10	2 3	3	1	2 7

The foregoing tables are very interesting; in fact, they almost seem too good to be true. They are, however, based on actual results obtained from a series of experiments; further, they are such simple experiments that anyone can easily substantiate them for himself. An illustration which supports the evidence of the tables just referred to is given below. It gives the actual results of a series of experiments carried out in a private house to check the electric oven makers' statement—that a saving of at least 10 per cent. would be effected if their apparatus was used instead of a gas oven or a coal range—a statement which apparently claimed too much, whereas it will be noted that it erred very considerably on the side of modesty :—

Date, 1911.	Joint.	Weight before cooked.	Weight when cooked.	Type of oven.	Loss of weight.	Loss per cent.
		lb. oz.	lb. oz.		lb. oz.	
Mar. 23	Ribs of beef ...	5 7	3 12	Coal	1 11	31
„ 26	Leg of mutton ...	8 8	5 13	„	2 11	31·7
„ 29	Should'r of mutton	6 13	5 1	„	1 12	25·7
Apr. 2	Leg of mutton ...	8 4	6 0	Gas	2 4	28·1
„ 9	Leg of mutton ...	8 0	7 12	Electric	1 4	13·9
„ 15	Should'r of mutton	4 12	4 2	„	0 10	13·1
„ 16	Ribs of beef ...	9 1	7 6	„	1 11	18·6
„ 23	Leg of mutton ...	9 1	7 10	„	1 7	15·8
„ 30	Should'r of mutton*	5 10	5 0	„	0 10	11·1

* The last item shows the best results, *i.e.*, the least shrinkage. This is explained by the fact that the use of the electric oven was better understood with practice.

The householder who carried out the experiments made comments as follows upon his experiences :—

1. The great convenience and thorough cleanliness of electric cooking.

2. The cost of the electricity consumed compares very favourably with that of gas or coal.

3. That once electrically cooked joints, poultry, &c., have been tasted, no one will want to go back to the gas or coal-cooked article, with its drawn and shrivelled appearance.

It may be of interest to mention that the oven used in the above-mentioned experiments was one of the "Tricity" cookers.

Another actual example, obtained in a private house, is as follows :—

Weight of Joint (Top Side of Beef).

	Coal range.		Electric oven.	
	lb.	oz.	lb.	oz.
Weight uncooked ...	5	4	4	0
Weight cooked ...	3	6	3	8
Loss in cooking ...	1	14		8
	35·7 %		12·5 %	

Therefore, with electric cookers, 4 lb. may be purchased instead of 5¼ lb.

The next question that is sure to occur is, do these savings amount to anything, or are they only a paper calculation? This is again best answered by citing an actual case. The cooker used was of the "Tricity" make.

In a £70 a year house, with six persons resident practically all the year round, the butcher's bills with coal cooking averaged over several years £52 per year. The first year's use of electric ovens reduced the butcher's bill to £38, while the coal consumed was 8 tons instead of 16 tons. Summary :—

	Old style.		Electric.
Butcher's bills ...	£52		£38
Coal bills	18		9
Electricity bills. Lighting only at 5d. per unit, with carbon lamps	13	Lighting at 4½d. per unit with metal lamps & cooking at 1½d. per unit ...	18
	£83		£65

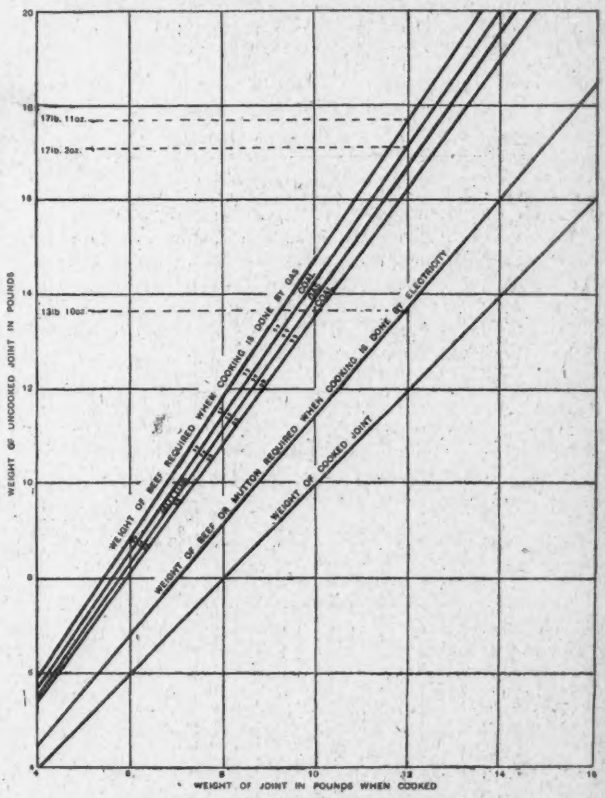
Net cash saving ... £18 per annum.

Another record of a test carried out by a private consumer was as follows :—

Gas Oven.—Joint, leg of mutton; weight before cooking, 12 lb. 4 oz.; after cooking, 9 lb. 3 oz.; loss in weight, 3 lb. 1 oz.; percentage loss, 25 per cent.

Electric Oven.—Joint, leg of mutton; weight before cooking, 11 lb.; after cooking, 9 lb. 1 oz.; loss in weight, 1 lb. 15 oz.; percentage loss, 17·6.

The cost of cooking the joint in the gas oven was 3½d., and in the electric oven 3¼d. The value of the meat saved by the smaller shrinkage in the electric oven than in the gas oven was 1s., and in addition there was the slight saving of ¼d. in the cost of cooking. The electric oven used was of the "Marylebone" type, which is very similar in appearance to the ordinary gas oven.


WEIGHT OF UNCOOKED JOINT IN POUNDS
WEIGHT OF JOINT IN POUNDS WHEN COOKED
17lb. 11oz.
17lb. 2oz.
13lb. 10oz.
WEIGHT OF BEEF REQUIRED WHEN COOKING IS DONE BY GAS
WEIGHT OF BEEF OR MUTTON REQUIRED WHEN COOKING IS DONE BY ELECTRICITY
WEIGHT OF COOKED JOINT

The following is a comparison of results obtained by an expert in gas cookery :—

Losses in cooking meat when gas, coal or electric ovens are used, respectively. Example: If 12 lb. of cooked beef are required,

12 lb. 10 oz.	must be put in the	Electric	oven, as the loss is	1 lb. 10 oz.
17 lb. 2 oz.	„ „ „	Coal	„ „ „	5 lb. 2 oz.
17 lb. 11 oz.	„ „ „	Gas	„ „ „	5 lb. 11 oz.

Conversely, if 12 lb. of uncooked beef is put in an

Electric	oven, it will weigh 10 lb. 8 oz. when cooked.			
Coal	„ „ „	8 lb. 7 oz.	„	„
Gas	„ „ „	8 lb. 1 oz.	„	„

Gas Oven.—Joint, leg of mutton; weight before cooking, 3 lb. 4 oz.; weight after cooking, 2 lb. 12 oz.; loss, 8 oz.; time taken to cook, 1 hour 10 min.; percentage of loss, 15·4 per cent.; cost of cooking, 1·9d.

Electric Oven.—Joint, leg of mutton; weight before cooking, 3 lb. 7 oz.; weight after cooking, 3 lb. 2 oz.; loss, 5 oz.; time taken to cook, 1 hour 15 min.; percentage of loss, 9 per cent.; cost of cooking, 1·8d.

The value of the meat saved by the less loss in the electric oven, as against the gas oven, was 2¼d., which will be seen to be more than the cost of cooking the joint.

Note.—The loss in a gas stove when in the average cook's hands would be nearer 12 to 16 oz. The cook who

carried out this test is an expert on gas cooking, and the finest regulation obtainable by the gas cooker was used. This was the first occasion on which this cook used an electric oven, and the latter was of the "Marylebone" pattern.

The following is a comparative test of gas and electric cooking (Harold Gray) :—

	Size of oven.	Weight of bread.	Time.	Consumption.	Cost per lb. bread.
Gas ...	6,400 cb. in.	8 lb.	58 min.	31 ft.	0·128d.
Electric ...	6,137 cb. in.	9 lb.	52 min.	0·92 unit	0·102d.

The figure for the cost of electricity per lb. of bread is the average of seven tests taken over a lengthened period. The figure for gas is the average of four tests.

Cooking Meat.—The average consumption of electricity per lb. of meat is just over one-fifth of a unit. This is borne out by the following series of experiments :—

Weight of joint in lb.	Time, h. m.	Units consumed.	Units per lb. of meat.	Cost at 1d. per unit. s. d.
32	5 0	9	0·281	0 9
38	5 0	9	0·237	0 9
40·5	4 0	11	0·271	0 11
41	4 10	8	0·195	0 8
41	5 0	10	0·243	0 10
41	5 30	9	0·219	0 9
41·5	4 0	9	0·216	0 9
43·5	5 30	11	0·252	0 11
48	6 0	13	0·271	1 1
53	6 20	11	0·207	0 11
58·5	7 40	13	0·222	1 1
87	7 30	14	0·161	1 2

Electric Cooking Data.

The following costs of cooking and baking by electricity are important as giving authentic and complete data on this subject, and it should be particularly noted as significant, that the cost per person per meal for cooking by electricity is not only practically the same in the following cases, but agrees very closely with the results obtained in many other instances where the observations cover even longer periods.

The results approximate 300 watt-hours per meal per person (say one-third of a unit).

Costs over Eight Months.—The table below gives the details of the cost, and the energy consumption for doing absolutely all of the cooking and baking by electricity in a private house, covering a period of eight months :—

Dates.	Units.	Cost at 1d. per unit.	No. days 3 meals each.	No. days 2 meals each 1 person.	Equivalent No. persons per day.
			2 persons		
June 23—July 24 ...	71	5/11	31	17	2·55
July 24—August 22 ...	71	5/11	29	18	2·62
August 22—Sept. 24... (House closed 2 wks.)	31	2/7	17	5	2·30
Sept. 24—Oct. 22 ... (House closed 2 wks.)	26	2/2	19	4	2·21
Oct. 22—Nov. 22 ...	63	5/3	32	28	2·51
			3 persons		
Nov. 22—Dec. 22 ...	87	7/3	29	16	3·55
Dec. 22—Jan. 22 ...	87	7/3	31	25	3·81
Jan. 22—Feb. 22 ...	97	8/11	31	22	3·71
Eight months' total	533	£2/3/5	219	135	3·69

Total single-person days 674
" " meals... 1,887
Units per person per meal... ... ... 0·282 total average.
Cost at 1d. per unit 0·282d. per person per meal (just over ¼d.).

Costs over Three Months.—The following is a record of the use of electric cooking utensils by a family of four :—

Total number of days in use 90
Units consumed 400
Average units per day ... ... 4·45
Average cost per day 4·45d. (nearly 4½d.)
Units per person per meal ... ... 0·37

The utensils used and proportion of energy used by each were as follows :—

Oven ... ... 25 per cent.
Water-heater ... ... 30 "
Disk stove ... ... 15 "
Broiler ... ... 15 "
Frying pan ... ... 10 "
Grid and coffee percolater ... ... 5 "

Costs over Three Months.—The following table shows the results of comparative experiments on the cost of electric cooking for three persons. These experiments were carried out in Switzerland during a period of three months (W. R. Cooper) :—

Period. 1901.	Consumption (units). One month.	Per day.	Cost per day with energy at 1d. per unit.
March 22nd—April 22nd	67·04	2·24	2·24d.
May 1st—May 31st ...	63·55	2·19	2·19d.
June 1st—June 30th ...	66·31	2·21	2·21d.

The cost of cooking with paraffin oil in the same case was 3·3d. per day (1½ quarts of oil).

Costs over One Month.—The particulars below give in great detail the results of a careful record taken in a private house during a period of 30 days :—

Total units for 30 days...	137
Units per day for month	4·5
Number of dishes cooked during 30 days	288
Number of regular meals (three meals per day) served during the month	90
Total number of meals...	116
Average number of persons per meal per month ...	3·9
Number of individual meals served during month ...	351
Units per meal per person per month	0·39
Units per meal	1·52
Maximum demand shown by Wright demand meter in KW.	2·0
Maximum demand shown by recording ammeter charts	3·2

(This 3·2 KW. peak occurred for 7 minutes about 8 a.m., January 5th. It does not occur at any other time during the month. It was caused by using the oven and several other appliances at the same time.)

Maximum demand during station peak, or between 5.30 and 6 p.m.	1·3
Load factor with 1·3 KW. as a maximum, 14 per cent.; load factor with 2 KW. as a maximum, 9·5 per cent. Number of times oven was used...	27

(The abnormal conditions are shown by the last figure, as the average family will hardly use an oven on the average nearly once a day for a month. This was caused by the necessity for special cooking. As the oven consumes more energy than any of the rest of the apparatus, its frequent use, of course, makes the total consumption for the month above normal.)

The average of the monthly gas bills for this family, for the eight months before electric cooking was begun, with gas at 3s. 6d. per thousand, was 9s. 6d. For 16 months previously to that when gas was 4s. per thousand, the average bill was 12s. 6d. Several years ago, before gas was piped in the neighbourhood, the anthracite coal range used by this family took a ton of coal a month regularly.

For a time before, oil was used for cooking exclusively and approximately 12s. worth of oil was consumed every month.

The electrical apparatus used was as follows :—One two-quart combination porridge cooker, steamer and water boiler; one 8-in. three-heat stove with 5-quart saucepan; one two-heat frying pan; one coffee percolator; one broiler; one oven; one 7½-lb. flat-iron; one stove and chafing dish.

Examples of Single Meals.—Below will be found some particulars of electrically cooked meals :—

Meal.	Food cooked.	Time. Min.	Units.	Cost.
Breakfast—4 people	Coffee; fried potatoes; bacon.	20	0·7	0·7d.
Breakfast—4 people	Coffee; porridge; steak; fried potatoes.	40	1	1d.
Breakfast—5 people	Coffee; porridge; bacon and eggs; fried potatoes	30	1	1d.
Lunch—3 people	Fish; potatoes; pancakes.	20	0·25	¼d.
Lunch—2 people	Chicken fricassee; peas; apple fritters.	20	0·5	½d.
Lunch—3 people	Cutlets; mashed potatoes; blanc-mange and stewed fruit.	35	1·2	1·2d.
Dinner—4 people	Soup; pork chops; boiled potatoes; jam omelette; coffee.	50	1·35	1·35d.
Dinner—5 people	Soup; chicken; cauliflr; potatoes; queen pudd'g.	75	2·5	2·5d.
Dinner—5 people	Soup; boiled salmon; veal chops; boiled potatoes; stewed apples; coffee.	55	2	2d.
		-	10·5	10½d.

Cost per person per meal, at 1d. per unit, a little under ¼d. (0·3d.).

Number of persons.	Food cooked.	Units consumed.	Cost.	Method of cooking.
Five.	4½ lb. corned beef (boiled); potatoes; cabbage; beet-root; cup custards.	2·24	2½d. (2·24d.)	Steamer.
Six.	4½ lb. roast pork; potatoes; turnips; 2 apple pies; 3 loaves bread; coffee.	6·15	6d. (6·15d.)	Oven (chiefly).
Eight	4 lb. corned beef; carrots; parsnips; turnips; cabbage and potatoes; 2 fruit puddings; 2 large apple pies; 2 loaves brown bread; 1 doz. small cakes; 1 doz. buns.	6·04	6d. (6·04d.)	Steamer and oven.

Cost per person per meal, ¾d.

Toasting.—Small toasters, toasting four slices of bread at once, cost 1d. to operate for 160 slices.

Full electrical details of a dinner prepared on January 9th, 1911, on a Simplex cooker, are given below :—

Soup	1 quart
Cutlets	6
Sirloin of beef	7 lb.
Potatoes	2 „
Sprouts	12

Time.	Meter.	Switch.	Operation.	Amps.	Remarks.
5·18	39·35	Maximum	Oven warming up	11	Oven at full
5·34	39·35	„	12 mince pies	10	—
5·51	4·60	Min. only oven	—	7½	Oven heat reduced to min. only
5·55	40·69	Min. only oven	Mince pies finished	—	do.
5·56	40·71	Min. only oven	Meat in (7 lb. sirloin)	—	—
5·57	40·77	Small boiler at full heat	Potatoes in (2 lb.)	8	do.
6·11	41·15	Max. switch only	—	10	Oven at max. only
6·19	41·41	Min. only for small	—	—	—
6·23	41·53	Small boiler off	Potatoes placed in oven for finishing	6½	—
6·48	42·09	Oven at full	—	10	Oven at full
6·53	42·29	Large boiler at full	Sprouts put on	13	—
7·15	43·34	Grill (full)	—	—	—
7·16	43·39	Oven max. only	—	16	—
7·25	43·86	Large boiler max. only	—	15·5	—
7·28	43·98	Large boiler off	Sprouts finished	14	—
7·29	44·02	Oven on min. only	—	10	—
7·35	44·22	Oven off	Heat finished	6	—
7·45	44·43	Grill off	Grill „	—	—

Cost of Electricity as Compared with that of Coal and Gas.—The figures given in the foregoing tables show that the cost of cooking by electricity is exceedingly reasonable. But it is necessary also to compare the price with that of gas and coal, and this comparison shows that where gas costs 2s. 6d. per 1,000 cb. ft., and electricity is 1d. per unit, the actual costs of cooking are about equal, while even at 1½d. per unit, electricity is cheaper than coal. But the economy in electric cooking lies not so much in the actual amount of money paid out for the energy used, but rather in the economy effected by the satisfactory manner in which the food is cooked, without the usual waste and loss due to shrinkage. Moreover, there must also be taken into account its accompanying advantages of perfect cleanliness, and the entire absence of fumes, smell and smoke—its saving of labour in many directions, and its uniformity of results. When all these points in its favour are brought into consideration, it must be acknowledged that the adoption of electric cooking will be fully justified from an economic point of view.

Average Electricity Bills.—From the experience of the writer, the amount of energy consumed in cooking for a family of from three to five persons works out at an average of one-third of a unit per meal per person. This average is demonstrated by the results already given in tabular form, and is also confirmed by the well-known scientist, Dr. Fleming, F.R.S., in his Cantor Lecture at the Royal Society of Arts, London, "Applications of Electric Heating," when he said that on the lines of the rule for making tea—*i.e.*, "one spoonful for each person and one for the blessed pot," the amount of electricity consumed in an electric oven for cooking purposes might be stated as a unit per day per person and two or three more for the oven. Reckoning the rate for a unit to be 1d. (which is now a usual charge for power and cooking), the monthly bill for electricity used for cooking purposes will come to from 3d. to 5d. per day, or 7s. 6d. to 12s. 6d. per month, for a family of three to five. This compares very advantageously with the price of coal.

One central station made a careful tabulation of the bills of 50 of its consumers who were doing all their cooking by electricity, and found that they averaged 18s. per month, ranging from 12s. to 24s. per month, depending upon the number of persons cooked for, the rate being 2½d. per unit. These figures indicate clearly that the cost of electric cooking is very reasonable, even when its accompanying advantages are not taken into consideration. In many towns the price of electricity used for heating and cooking is much less than 2½d. per unit, the rate upon which these latter figures are based.

There is a wide, unfilled gap between the manufacturer and the user of electric ovens, which very few are taking steps to lessen. The Berry Construction Co. are noteworthy on account of the great trouble they have taken to bridge this gap, by the establishment of a working kitchen that is in regular operation. Firms who do this sort of thing should know a good deal more about the practical requirements of cooking apparatus than those who only occasionally test an oven on actual cooking, with a fitter as an amateur cook.

Among central stations which are aiding in this good work, the Borough of St. Marylebone Electricity Supply Department, and the Brompton and Kensington Electricity Supply Co. are worthy of special mention, as they have passed beyond the stage of playing with electric cooking, which so many do nowadays, and have fully equipped kitchens, which they use.

Electric ovens are still somewhat expensive appliances as compared with the cost of gas stoves. Still, it must be remembered that they are better made and have a greater thickness of heat insulating material. The cost, however,

Some Standard Electric Ovens.

Make.	Dimensions of oven in inches.	Cubic inches.	Cubic feet.	Watts taken by Oven.	Boiling plate, No. 1.	Boiling plate, No. 2.	Hot plate.	Grill or frying pan.	Total watts.
B.T.-H.	18 × 10½ × 14½	2,744	1·59	1,500	—	—	—	—	1,500
Eclipse	21 × 13½ × 13½	3,820	2·22	2,000	800	800	—	800	4,400
Marylebone	20 × 15½ × 16	4,960	2·87	2,500	1,200	1,000	—	1,200	5,900
Phœnix	18 × 14 × 14	3,522	2·04	2,000	750	750	500	1,000	5,000
Prometheus	20 × 13 × 10½	2,725	1·58	1,875	—	—	—	—	1,875
„	18 × 18 × 22	7,128	4·12	4,000	1,000	750	—	500	6,250
Simplex	18½ × 14 × 14	3,624	2·1	2,400	1,000	750	750	1,000	5,900
Therol	16 × 15½ × 14	3,416	1·97	300*	—	—	—	—	300
Tricity	14 × 16 × 16	3,584	2·08	1,600	800	—	800	—	3,200
„	12 × 12 × 12	1,728	1	800	800	—	—	—	1,600
Verity	19½ × 12 × 15	3,505	2·03	2,000	—	—	—	—	2,000

* This also provides the heat for two boiling connections on the top of the stove. An additional incandescent heater for browning, of 350-watt capacity, can be put on when required, the current being temporarily switched off a water heater for this purpose.

is being reduced, as larger numbers are being sold. As long as the number of ovens in use is not too great, the load they give is very welcome to the central station manager. Londoners do not seem to appreciate that the custom of dining in the evening is the exception in country towns rather than the rule, hence there is no real fear of the heating peak coinciding with the lighting peak outside of London.

Should the cooking load become greater than the lighting load, there is no question that it will be difficult to handle properly when the ordinary apparatus is employed. Here then is the field for the heat storage oven, of which the "Therol" is an example, for taking, as it does, only a very small amount of power throughout the 24 hours of each day, it provides that load factor of 100 per cent. that every engineer is searching for.

Though the above comments have referred more particularly to domestic cooking, restaurant work can also now be carried out economically with electrical apparatus. The writer recently reported upon and advised a large London Institution to install electric cooking apparatus with a capacity for cooking 200 dinners daily, and is now superintending the installation of the apparatus. Of course, a cooking plant of this size would not have been considered unless it were conclusively shown that it was better and more economical than any other method.

The Navy Department of the United States have decided upon the adoption of electric ranges and baking ovens as the standard cooking apparatus for their men-of-war, not only on the score of cleanliness, convenience, compactness and improved hygienic conditions, but also because electric ovens are slightly less expensive to operate than a coal range.

In conclusion, it may be mentioned that, of course, it is impossible to deal very comprehensively with such a big subject as electric cooking, in the limited space available here, but sufficient has been said to show that it is by no means any longer a visionary art.

THE ADVANTAGES OF ELECTRICITY IN THE PRINTING OFFICE.

From the Owner's Point of View.

The advantages of electric lighting and driving as applied to printing offices have been frequently referred to in our columns, but as the arguments are usually from the point of view of the electrical engineer, it might be said that they are not always quite disinterested. It is rarely that we are able to obtain the real views of the printing works proprietor, as there is naturally a tendency on his part not to emphasise the benefits which he has obtained, either in economy or in other directions, as a result of the electrification of his works, and we are therefore all the more pleased to give prominence to these views when they are expressed.

In a recent issue of the *Illustrated London News* a special supplement was included, which dealt very thoroughly and exhaustively with the production of this well-known and excellent publication. The works have been recently reorganised under the direction of the printing works manager, Mr. Rudd, who is recognised as one of the ablest men in the printing trade, and a complete system of electric light and power formed a part of the more comprehensive scheme. A few years ago the firm introduced one or two motors with a view to testing the question of economy, but it was decided as a result of these tests that, at the prices then charged for electricity, very little economy was to be gained. Since that time electric supply companies have cultivated and encouraged the power consumer, and prices have come down very considerably. When the reorganisation was put in hand, the firm called in an electrical expert, viz., Mr. Frank Broadbent, who is retained as technical adviser by several important London printers, and after going carefully into the matter, he advised them that very considerable economies could be effected in the cost both of power and lighting, assuming that suitable terms could be arranged with the supply companies.

As a very considerable proportion of the load is an all-night load, it was not difficult to arrange satisfactory terms, and the results, judging from the expressions of opinion in the special supplement referred to, have fully come up to expectations. The technical details of the installation are not enlarged upon in this general description, and these, as a matter of fact, are not of very great interest to the proprietors, who are more concerned with actual results. The following quotations from the article referred to will be of considerable interest to our readers, and will put into their hands arguments which are capable of being used with considerable effect in connection with any similar schemes which they may have in view.

Dealing with the general conditions of the electric driving, the proprietors say :—

> Perhaps most important of all the recent alterations which have been made in the change from the older style to the present model office, is that of the adoption of electrical driving. The complete reorganisation of the works is surely nowhere more successful than in this direction. More wonderful still is the fact that the transformation was so effected that regular work was continued and no stoppage whatever resulted. The couple of horizontal compound engines and the old beam engines have gone entirely, together with their boilers, and the space they occupied provides a much-needed extension of accommodation for machines.
>
> It is most difficult to realise, when standing in one of these rooms, that only recently older machines were installed, and that a perfect tangle of shafting and belting occupied the air space above the presses. When one's eyes rest appreciatively upon the spick-and-span automatically operated and motor-driven presses, remembrance of the older condition arouses something like a shudder. And do not forget that the former equipment was also very good in its way and was typical of many of the best London offices.

The safety of electricity is emphasised in the following terms :—

> Danger from fire is minimised very considerably by the adoption of electric lighting and electric driving, with the consequent absence of openings for belting from floor to floor, the removal of the old steam boilers and the gas jets. These have given place to newer and safer methods.
>
> There is an entire absence of shafting and belting overhead, and thus no dust and grease flies about, the workers are safe from the risk always accompanying belts and shafting, and the gain in light and general access is beyond praise.
>
> The whole installation is not only entirely successful in providing safe and reliable means of lighting and driving, but in comparison with the cost of the older methods is wonderfully economical. Thus, the establishment not only gains materially in regard to cleanliness and light, but the electrical power for the machines does away with noisy and dangerous shafting and belting. In actual cost, too, there is a gain, this being but one-third of the former heavy charge.

REPORT ON CHARGES FOR ELECTRICAL ENERGY SUPPLIED FOR TRACTION PURPOSES FROM COMBINED STATIONS.

The Joint Committee of representatives of the I.M.E.A. and the M.T.A., which has for some time been considering the above matter, has come to the conclusion (subject to the reservations and general notes which follow) that the following broad principles should be adopted as the basis for the charge for electrical energy supplied for traction purposes from combined stations, viz. :—

1. That the charge should be based upon the actual cost of production.

2. That in order to ascertain the actual cost of production it is necessary that the "standing costs" and the "running costs" should be properly separated, and the following allocation is suggested, subject to the general observations subsequently made in this report, viz. :—

	Standing costs.	Running costs.
Coal...	25 %	75 %
Oil, waste and water	25 %	75 %
Repairs :—		
(*a*) Building	100 %	—
(*b*) Steam boilers, piping, &c. ...	75 %	25 %
(*c*) Engines and generating plant...	50 %	50 %
Repairs of joint mains in case of high-tension stations	100 %	—
Wages at generating stations	50 %	50 %
" " sub-stations	100 %	—
Salaries of operating officials	100 %	—
Rents, rates and taxes on joint assets (not including income-tax) ...	100 %	—
Management expenses (salaries of administrative officials)	50 %	—
Interest in respect of all capital which is used in common for the various classes of supply	100 %	—
Depreciation in respect of all assets used in common for the various classes of supply	100 %	—

3. That the tramways department's proportion of the standing costs should be the ratio which the maximum demand for traction purposes at the generating station bears to the total maximum demand on the generating station, such maximum being arrived at in the same manner in each case as hereinafter set forth.

4. That the tramways department's proportion of the running costs should be the ratio which the total number of units delivered to feeders at the station for traction purposes bears to the total number of units delivered to feeders at the station for all purposes.

5. That the traction maximum demand should be taken to be the mean of the figures representing—(1) the maximum traction demand at any time of the year, and (2) the average of the daily maximum traction demand (Sundays excepted) taken over a period of a month coincident with the maximum demand on the station.

The method of ascertaining the traction maximum shall be taken as the maximum observed load, deducting therefrom 20 per cent.

6. That in cases where storage batteries are in use the figure to be adopted as the traction maximum demand, and used for allocating to the tramways department their proportion of the standing costs under the headings of :—

(*a*) Rents, rates and taxes, and

(*b*) Management expenses

should be the generating plant maximum plus the battery—and for the purpose of allocating the remaining standing costs—*i.e.*,

(*a*) Coal.

(*b*) Oil, waste and water.

(*c*) Repairs.

(*d*) Wages at generating and sub-stations, and

(*e*) Salaries of operating staff,

the maximum demand to be adopted should be the maximum demand of the generating plant only.

That the two-hour rating of any storage battery should be deemed to be its kilowatt capacity, and that all repairs to the battery, which could be used for the dual purpose of lighting and traction, should be dealt with in the same manner as repairs to engines and generating plant. If, on the other hand, it is put in for purely traction purposes, it should be dealt with under the heading of repairs to exclusive traction plant.

7. That the total costs in respect of traction feeders and any other apparatus connected exclusively with traction distribution should be wholly allocated to the tramways department, such costs to include interest, depreciation and repairs.

8. That it is desirable, as a matter of ordinary commercial prudence, that there should be established in connection with electrical undertakings a suitable reserve fund for meeting any extraordinary expenditure in any year, and that the tramways department should bear their proper proportion of the annual sums to be set aside for establishing such reserve fund, but it should be an understanding that the tramways department should be a party to the fixing of the annual amounts to be so set aside.

9. That the total actual cost of production of current for traction purposes may be summarised under the following heads, viz. :—

(*a*) Proportion of standing costs (ascertained as per Paragraphs 2 and 3).

(*b*) Proportion of running costs (as per Paragraphs 2 and 4).

(*c*) Total cost of traction feeders, &c. (as per Paragraph 7).

(*d*) Proportion of reserve fund (as per Paragraph 8).

10. That the question as to what amount of profit (if any) should be paid to the electricity department by the tramways department, is a matter which each municipality should settle for itself. The Joint Committee have only endeavoured to lay down what they consider to be the correct method of ascertaining the actual cost of production, and upon which they suggest the charge should be based.

General Notes Made by the Joint Committee.

Coal Allocation as Between Standing and Running Costs.—The question as to the proper proportion of coal to be allocated to the standing costs received careful consideration by the Joint Committee. From the evidence in their possession it would appear that the amount of coal which is consumed to make up for radiation losses differs somewhat in the various stations. The general information obtained showed that it averages from 4 lb to 5 lb. per kilowatt of plant usefully employed per day. It is suggested by the Joint Committee that each municipality should carefully go into this matter with a view to ascertaining, as far as possible, the actual figure for their particular station. If, however, it is not thought worth while in any particular case to go into this detail, it is suggested that the division suggested by the Joint Committee should be adopted, viz., 25 per cent. to standing costs, and 75 per cent. to running costs.

Oil, Waste and Water.—The Joint Committee, after considering the allocation under this head, suggest that it should follow the division proposed in the case of coal. They recognise that this may not be strictly accurate, but they think that the smallness of the figure does not justify a different allocation.

Repairs to Steam Boilers, Piping, &c.—The figures suggested as the allocation under this head are not less than 75 per cent. to standing costs, the balance going to running costs. The Joint Committee suggest that the figures should be settled for each station having regard to local conditions.

Salaries of Operating Officials.—Under this head it is suggested that only the salaries of those officials should be included whose services are devoted to generation and transformation of electrical energy.

Management Expenses (Salaries of Administrative Officials).—Under this head the proposal is to include the salaries of the administrative staff as apart from the staff engaged at the generating station. It would include the salary of the chief engineer, the secretary, the accountant, and officers of that class. It will be observed that it is proposed to allocate half only of the management expenses to standing costs, the remaining half having no connection with the traction supply, is eliminated from the calculations.

Interest and Depreciation.—The capital it is suggested should be that which is used *in common* for the various classes of supply, and should be ascertained by taking the total capital expenditure of the undertaking and deducting therefrom all items which are *not* used in common, *e.g.* :—

Traction feeders; lighting feeders and distributing networks and services; meters, &c.; motors (for hire); any other plant not used for the *common* supply.

In calculating the depreciation charges it is suggested that the "lives" of the various portions of the assets should be fixed in accordance with the actual provision made by the electricity department.

Method to be Adopted for Accurately Measuring the Current supplied for Traction Purposes.—The Joint Committee suggest that all direct-current meters should be of the watt-hour type. When fixed in positions where they are liable to be affected by stray magnetic fields they should be astatic, and of a type containing no iron or permanent magnets, and should not be affected by momentary overloads or short circuits. Where meters containing permanent magnets or iron are used, it is advisable that they should be shielded as much as possible.

It is further desirable that all meters should be calibrated for the temperature of the surrounding medium in which they will be located. For loads up to 2,000 amperes the total current type is recommended, and above this output the shunted type—each with its own shunt.

Where polyphase currents have to be measured "Dynamometer" or "Induction" type meters may be used.

It is suggested that the two-wire wattmeter method should be employed as being the most satisfactory way of metering three-phase electrical energy.

The Joint Committee recommend, having regard to the importance of reliable measurements being obtained, that in all generating stations three wattmeters should be arranged in series. One meter being the property of the tramways department.

In all important sub-stations they consider that two wattmeters will suffice, one of which would also be the property of the tramways department.

Provision should be made for reference to an independent authority in the event of any dispute arising as to the accuracy of any or all of the meters installed.

Reservations made by the Joint Committee.

Traction Maximum Demand.—The Joint Committee in Paragraph 5 have suggested a method of ascertaining the traction maximum which they are of opinion could be equitably applied to the majority of tramway undertakings in the kingdom; they consider, however, that it might not be applicable in every case where the "peaks" are accentuated or where the ratio of

$$\frac{\text{Sustained maximum demand}}{\text{Average maximum demand}}$$

is of an abnormally high value due to (*a*) geographical, or (*b*) service conditions. As an instance of the former they cite the case of those towns having very severe gradients on their system, and as an instance of the latter, the case of those towns having to deal with football or other abnormal rush traffic.

Capital Charges.—The Joint Committee have set forth in Paragraphs (2) and (3) and further amplified in the "General Notes" what they consider is the most practicable method of treating the question of the capital charges in the ascertainment of the costs of traction supply. They are aware, however, that circumstances may arise in connection with the development of electrical undertakings which might properly justify some departure from the method suggested.

They have had under their notice the case of stations where the principle of dealing with the capital charges on the "common plant" basis, or the "pooling system" as it may be termed, would not be in the best interests of either the electricity or the tramways undertakings. They therefore suggest the following as an alternative basis which might be applied in cases which come within this category, viz :—

(*a*) That the tramways department's proportion of the charges for interest on capital expenditure in respect of generating and transforming plant and boilers should be based upon the cost per kilowatt for such plant at the time of its installation, the amount of such plant to be ascertained on the maximum demand principle already described, plus a reasonable allowance for reserve or spare plant to be determined in accordance with the local conditions.

(*b*) That the tramways department's proportion of the interest on the capital in respect of land and buildings should be based upon the proportion which the kilowatt capacity of the traction plant bears to the total kilowatt capacity installed.

(*c*) That the depreciation charges should be determined in accordance with the paragraph under the heading of "General Notes" contained in this report.

The Joint Committee cannot make any recommendation as to which of the two methods outlined should be applied in any particular instance. Each case should be settled on its merits, having regard to the local conditions, and in the event of any dispute arising, the Joint Committee suggest that provision should be made for referring the matter to an independent engineer for settlement.

The Joint Committee acknowledge the special assistance which they have received from the Sub-Committee, consisting of Mr. S. L Pearce (Manchester), and Mr. T. Roles (Bradford), representing the I.M.E.A.; and Mr. J. M. McElroy (Manchester) and Mr. C. J. Spencer (Bradford), representing the M.T.A.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,576. "Means of charging tramway mains from a three-wire lighting system and *vice versa*." W. A. Stevens. September 18th.

20,586. "Regulator for dynamo-electric machines." T. Ferguson. (Convention date, September 17th, 1910, United States.) September 18th. (Complete.)

20,588. "Means of locking incandescent electric lamps into their holders." C. Spencer. September 18th.

20,614. "Arc lamps." H. E. Moul. (M. Korting, Germany.) September 18th.

20,620. "Telephone installations." W. E. Lake (firm of Gustav A. Meyer-Henniger, Germany.) September 18th. (Complete.)

20,631. "Holders for incandescent electric lamps." R. F. Peel. September 18th.

20,636. "Protective devices for dynamos, electromotors, and similar electric machines." F. V. Schiodt. (Convention date, September 17th, 1910, Germany.) September 18th. (Complete.)

20,638. "Apparatus for recording telephonic communications on phonographic dictating machines." A. Baumgartner. September 18th.

20,659. "Insulation of electric conductors." British Westinghouse Electric and Manufacturing Co., Ltd. (K. C. Randall, S. W. Farnsworth and C. Le G. Fortescue, United States.) September 19th. (Complete.)

20,667. "Electric condensers." Electric and Ordnance Accessories Co., Ltd., J. R. Garner and N. Collins. September 19th.

20,693. "Construction of armatures for dynamos, electric motors, and other electric machines." A. Cattaneo. September 19th.

20,695. "Apparatus for electrically heating water." W. H. Chipperfield. September 19th.

20,709. "Operation of electrical machines of the induction type." W. A. Price. September 19th. (Complete.)

20,713. "Treatment of salammoniac skimmings." G. Rigg. (Convention date, November 12th, 1910, United States.) September 19th. (Complete.)

20,718. "Electric shade carrier tongs." J. Ball. September 19th.

20,733. Motor-feed mechanisms for electric arc lamps and the like." H. J. Booker. September 19th.

20,745. "Electric sign or display system and apparatus therefor." E. M. Wildey and H. C. Merrett. September 19th.

20,761. Method of and means for changing the frequency of alternating currents." A. M. Taylor. September 20th.

20,787. "Working of telegraph and telephone circuits and the like." E. S. Heuatley. September 20th.

20,794. "Series electrical incandescent lighting." B. C. Atherton. September 20th.

20,810. "Apparatus for producing a perforated paper slip by electric current impulses." H. Bille. (Convention date, April 7th, 1911, Germany.) September 20th. (Complete.)

20,818. "Telegraph instruments, relays, and the like." P. E. Davenport and S. G. Fermor. September 20th.

20,829. "Single-phase commutator motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) September 20th. (Complete.)

20,833. "Regulatable electric resistances." A. E. Naumann. September 20th. (Complete.)

20,850. "Magnetic earth-wave appliance." H. Harris. September 21st.

20,860. "Electromagnetic relays." Western Electric Co., Ltd. (Western Electric Co., Ltd., United States.) September 21st. (Complete.)

20,898. "Telephone apparatus." E. A. Graham. September 21st. (Complete.)

20,899. "Sparking plugs for internal-combustion engines." Firm of Robert Bosch. (Convention date, December 3rd, 1910, Germany.) September 21st. (Complete.)

20,903. "Means of governing the supply of electricity where a meter may not be desirable." G. Wallace and J. Elphinstone-Graham. September 21st.

20,904. "Dynamo-electric generators." G. Inrig and Gavan Inrig, Ltd. (Divided application, 20,754/10, May 2nd, 1911.) September 21st. (Complete.)

20,905. "Dynamo-electric generators." G. Inrig and L. Inrig. September 21st.

20,919. "Speed regulation of electrically driven ring-spinning and twisting frames." Siemens Bros. Dynamo Works, Ltd., and J. F. Crowley. September 21st.

20,943. "Means of warming and airing beds or the like by electricity whereby all parts are heated by radiant heat." A. R. Oxley and A. R. Martin. September 22nd.

20,987. "Branch-clamps for electric conductors." K. Walseck and H. Starcke. September 22nd. (Complete).

20,995. "Safety device for electric cables." Siemens-Schuckertwerke G.m.b.H. (Addition to 17,046, 1911. Convention date, May 2nd, 1911, Germany.) September 22nd. (Complete.)

20,996. "Safety device for electric cables." Siemens-Schuckertwerke G.m.b.H. (Addition to 17,046, 1911. Convention date, May 2nd, 1911, Germany.) September 22nd. (Complete.)

21,000. "Artificial lines used in duplex telegraphy." S. G. Brown. September 22nd.

21,001. "Automatic sectioning means for limiting accidental interruptions of current supply in central stations." E. Brandenburg. (Convention date, October 8th, 1910, Belgium.) September 22nd. (Complete.)

21,025. "Magneto-electric ignition apparatus." B. Brooks and F. H. Alston. September 23rd.

21,026. "Electric heating apparatus." C. M. Holmquist. September 23rd.

21,042. "Electrical cooking and heating apparatus." B. Thomas and E. Thomas. September 23rd.

21,054. "Electrical plug-and-socket connections." A. F. Berry. September 23rd.

21,055. "Telephonic apparatus." H. W. Sullivan and C. T. Hay. September 23rd.

21,069. "Compensating device for telephonic circuits." S. G. Brown. September 23rd.

21,070. "Trolley heads for electric tramcars and the like." R. H. Hillman. September 23rd.

21,072. "Electric pocket lamps." E. Neudorffer. (Addition to 14,604, 1911.) September 23rd. (Complete.)

Southampton Electric Lighting.—The Harbour Board has decided to expend £354 in bringing the electrical equipment at the Pier and Town Quay to a state of efficiency.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Portable Electric Battery Lamps. K. K. Smith. 20,378. September 1st.

Apparatus for Treating Liquids with Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen. 20,426. September 1st. Addition to 2,424/10.

Apparatus for the Electrical Production of Steel. T. Levoz. 20,594. September 3rd. (September 4th, 1909.)

Magnetic Separators. G. T. Meek. 21,045. September 9th.

Contact Clips for Electric Wires and Cables, Pipes and so forth. D. Nield. 21,406. September 14th.

Electrically Heated Cooking Stoves or Ovens. Electric and Ordnance Accessories Co. and J. D. Morrison. 21,468. September 15th.

Light Reflectors and Means for Supporting Incandescent Electric Lamps therein. R. G. Tyler and E. H. Freeman. 21,574. September 16th.

System of Point-Shifting Mechanism for Railways or Tramways, worked from the Locomotive or the Car by means of Electricity. E. Piscani, A. Pacini and O. Capellano. 24,524. October 22nd.

Means for Controlling the Traversing Motion of Electric Coal-Cutting Machines. T. W. Crossland and A. Crossland. 25,426. November 2nd.

Packing of the Plates of Electric Storage Batteries. B. M. Drake, J. Waddell and D.P. Battery Co. 25,516. November 3rd.

Holders for Electric Lamps. C. D. Copland. 25,897. November 8th.

Incandescent Electric Lampholders. J. Barnes. 26,282. November 11th.

Electrical Safety Fuses. G. Müller. 27,259. November 23rd.

Revolving Electrical Furnaces. O. Serpek. 29,715. December 21st. (Addition to No. 29,299 of 1910.)

1911.

Terminals for Ignition Plugs, Magnetos, and other Electrical Connections. W. H. Moore and Ambrose, Shardlow & Co. 12,924. May 20th.

Electric Arc Lamps. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke Ges.) 14,685. June 21st, 1911.

Electric Light Attachments. J. A. Williams and G. A. Gillies. 225. January 4th.

Electric Furnaces. H. Helberger. 419. January 6th.

Incandescence Electric Lamps. C. H. Weber. 1,210. January 17th. (March 26th, 1910.)

Magnetically Locked Miners' Safety Lamps. R. Cremer. 1,665. January 23rd.

Method of Constructing the Conduit and Track for a Slot System of Electric Traction. G. S. Albanese. 3,022. February 6th. (February 5th, 1910.)

"Intensive" Osram Lamps.—The Deutsche Gasglühlicht Aktiengesellschaft have just placed on the market "Intensive" Osram lamps for which they claim an efficiency of 0·8—0·9 watt per C.P. (hefner). This claim is certainly justified by Reichsanstalt tests (see abstract in Table I), but it will be noticed that these were only carried to 1,000 hours (whereas an average life of 2,000—3000 hours or over is now quite usual for Osram lamps), so that it is yet too early to decide definitely that a considerable fraction of the improved efficiency is not due merely to over-running the lamps.

The new lamp is available in 200, 400, 600 and 1,000 hefner units and for line voltages of 100—160 volts or 200—260 volts, but only for the lower voltage range is 0·8 w./hef. C.P. claimed; the 200—260-volt lamps consume 1 w./hef. C.P. The list prices of the several sizes are respectively 7s. 6d., 13s., 16s. and 22s., and the operating costs, per 1,000 hours, of various "Intensive" Osram and D.C. and A.C. arc lamps are claimed to be as shown in Table II (in which the lower mean hemi-spherical C.P. of the Osram lamps is taken = 1·12 × M.H.C.P., allowing for the reflectors employed).

TABLE I.—Summary of Average Reichsanstalt Test Data on Four "Intensive" Osram Lamps; 110·5 volts A.C.

Burning hours.	Current amps.	Hefner C.P. perpendicular to lamp axis (mean).	Watts per hefner C.P. perpendicular to lamp axis.
0·2	3·15	410	0·85
200	3·18	410	0·86
600	3·16	392	0·89
1,000	3·12	374	0·92

Best efficiency 0·83 w./C.P. after 200 hours; worst efficiency 0·98 w./C.P. after 1,000 hours (same lamp in each case).

TABLE II.—Comparative Costs, per 1,000 Burning Hours, of Various Lamps.

Lamp.	Lower mean h.-s. C.P. (hefner).	Cost per 1,000 burning hours (marks)* energy per B.T.U. at 4½d.	at 2d.
200-hefner "Intensive" Osram ...	224	89	46
400 " " ...	448	172	87
600 " " ...	672	253	125
4-amp. D.C. carbon arc	187	131	76
6-amp. D.C. " "	356	184	101
4-amp. D.C. long-hour arc ...	262	218	107
6½-amp D.C. " " ...	517	341	162
2-amp. D.C. "Sparbogenlamp" † ...	211	114	57
6-amp. A.C. arc	82·5	108	66
15-amp. A.C. arc	405	232	126

* Approx. shillings (1 mark = 11¾d.). † High efficiency arc.